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THE COST OF CENTRAL-STATION SERVICE.

The way in which various elements enter into the total cost of central-station service is well shown for the particular case of one large company in an article in this issue which is taken from a talk given by Mr. H. B. Gear at a recent meeting in Chicago.

Mr. Gear has analyzed the cost figures which go to make up the expense of rendering service in the city of Chicago, and while the same relative proportions might not hold between these elements in other communities where the conditions of load distribution, diversity, etc., are different, they nevertheless give one a definite idea as to what these figures may be in a typical case. In a portion of this analysis a distinction is made between customers served by direct current and those served by alternating current. It should be kept in mind that the differences found between these two classes are dependent largely upon the nature of the business and not merely upon the system of distribution employed. Such differences would not be found between a direct-current system and an alternating-current system if the load conditions were the same in the two cases. This is well illustrated in the item for the cost of meters. The meter cost on the alternating-current lines averages higher because alternating current is used in the outlying portions where the load consists largely of residence consumers. The number of meters is consequently large in proportion to the consumption of energy. The cost of a single meter of a given capacity is of course less for alternating than for direct current.

In our issue of October 18 we referred to the fact that the investment in distribution system for a central station is generally larger than for the generating equipment and an appraisal of the property of the Commonwealth Edison Company was cited in substantiation of that fact. Mr. Gear's figures not only emphasize this point but indicate that the investment in generating equipment is an even smaller item than was stated at that time and shows the total investment in generating plant to be but 26 per cent of the total investment in all departments.

These considerations will help to make it evident why the cost of electric service does not depend merely upon the number of kilowatt-hours used, since even when operating charges are included the cost of production only amounts to 30 per cent of the total

cost. The remainder is due to distribution and general expenses. Operating charges are less than half of the total cost and a portion of the operating charge is not proportional to energy consumed. It will thus be evident that the consumer who makes 20 hours' use of his maximum demand reduces his unit cost to a much lower figure than the customer who uses his for only two hours. This is well illustrated by one of the curves, which shows that the unit cost for one consumer may be more than six times as great as that for another.

WIRELESS COMMUNICATION WITH MOVING TRAINS.

A number of newspaper dispatches within the last few weeks announce successful demonstrations being made of wireless telegraph communication with a limited train on the Lackawanna Railroad. According to these accounts it seems that the train crew has been able to communicate with the railroad officials at Scranton for a variety of purposes affecting the service and that important current events had been communicated to the rapidly moving train from the Scranton station. While these dispatches lack definite confirmation, they point again to the great value of such service. Wireless communication with railroad trains has been attempted on a number of occasions with more or less success and while the feasibility of the scheme has been clearly demonstrated, its practicability as a regular service has apparently, or at least until the present time, not been clearly proven. In view of the skepticism with which the earliest attempts to secure wireless communication of any kind were regarded and of the extraordinary ultimate success and value of wireless telegraphy in connection with sea-going vessels, it would seem reasonable to expect that persistent experiments on wireless communication with trains should ultimately bear fruit.

The value of such an aid to the train dispatching and commercial telegraph service of railroads cannot be exaggerated. Great developments have taken place in railroad signaling in the last 15 or 20 years and particularly during the last year or two many efforts have been made to develop a practical cab-signaling means. Such systems will be of great value in supplementing the customary signals provided along the right of way, but at best such a system could provide only rather simple visual or audible signals according to some definite code. Wireless communication, on the contrary, will provide not only a system of code signals but a means of communicating actual complete messages and, therefore, will be a means of much wider scope. Evidently the greatest value of such wireless service, just as in the case of marine service, would be in warning the engine man of impending danger or of a change in dispatching orders. A high-speed train, of course, is most in need of every possible aid to insure its safety.

Again, high-speed trains are most frequented by opulent passengers who would like to keep in touch during a long journey with at least the most important events of the day and who would like, even at some expense, to communicate with their business offices or friends at various points during the trip. While this can now be done by telegraph during stops at stations, such service could be much expedited and could be made continuous through the use of radio apparatus. For this reason it seems likely that wireless communication would have considerable commercial value and that the revenue produced from this would offset the considerable cost of providing the service. Therefore, when wireless communication with moving trains is established on a permanent basis it probably will be introduced first on the high-speed limited trains, being extended to others as conditions warrant. At any rate, the great desirability of providing this service should stimulate further experiments along this line and every encouragement should be given to attempts to increase the distance to which a train can be reached and the reliability of the service in general.

ELECTRICITY AND INDUSTRIAL DISEASES.

One excellent result of the conservation propaganda so prominent in this country of recent years is the attention which has been called to the problem of caring for health; in other words the conservation of human beings. Too little attention has been given in the past to conserving of health and the combating of disease, especially those diseases which are fostered or caused by certain industrial occupations. The great toll in human lives which has been exacted in the handling of poisonous materials such as phosphorus, lead and arsenic, is unwarranted. We already have national legislation to meet this problem in the match industry, and legislation is being sought in many of our states to lessen the hazards of disease in other industries.

Lead poisoning is one of the ailments which has frequently been contracted in factories where this metal is handled, although it is claimed that under proper precautions the contraction of the disease can be prevented by such workers. Nevertheless it is a fact that this disease has not been stamped out and it is interesting to note the announcement in England of an electrical method of treating the disease. In a lecture before the Royal Institute of Public Health, Sir Thomas Oliver described the application of an electrolytic bath in the treatment of lead poisoning. Experiments have been performed not only upon animals but upon a workman who had contracted this disease while cleaning flues in a lead smelter. The subject was made the electrode in a bath through which current was passed, with the result that lead was transmitted to the electrolyte and the blue line along the gums of the subject, which is a well known symptom of this disease, disappeared. The general health of the patient was also much improved.

While it is probably too early to determine whether a complete cure can be effected by this method, it will be a welcome message to sufferers from this

trouble to know that it can even be alleviated. If the method should prove capable of effecting a definite cure it would prove a great benefaction to mankind.

THE KAHN LAW.

Complaints have been made by exhibitors at international exhibitions held in this country that the articles and designs exhibited have frequently been copied by American manufacturers, with the result that instead of extending his trade by means of his exhibit the exhibitor has found that the exhibit has been the cause of losing a portion of the trade already established. The benefits of exhibiting under such circumstances have naturally been questioned. To avoid such a contingency in connection with the Panama-Pacific Exposition, to be held in 1915, Congress has passed a law designed as H.R. 7595 and commonly known as the Kahn Act, which is intended to prevent the copying of patterns, designs, trademarks and manufactured articles which are placed on exhibition at that time.

This act, after providing for the duty-free importation of articles intended for exhibit, requires the Librarian of Congress and the Commissioner of Patents to establish a branch office at the Exposition to issue certificates to exhibitors who are the proprietors of any certificate of registration, copyright, trademark, or patent issued by any foreign government, which certificate shall be legal evidence of such proprietorship. A register of such certificates shall be kept at the office and be open to public inspection. It is declared to be unlawful for any person to copy, imitate, reproduce or republish any design or article protected by such registration and exhibited at the Exposition, and provision is made for enjoining such infringment and punishing infringers.

Since the enactment of this law a great cry has gone up from manufacturers in this country who are afraid that the effect of the law will be much wider than intended. It has been claimed that exhibitors of articles which are registered under the provisions of this act acquire rights equivalent or indeed in excess of those of holders of copyrights and patents in this country, and that regardless of the question of novelty or original invention which may be involved in them. It is even claimed that the foreign exhibitor may have stolen a trademark from a domestic manufacturer and by having this registered in a foreign country will acquire sole right to its use in the United States during the period of the Exposition and the three succeeding years during which the terms of the act remain in force.

It is difficult to see how the provisions of this law can be construed in the way which has just been indicated. The language of this statute provides "that it shall be unlawful for any person without authority of the proprietor thereof to copy, imitate, reproduce or republish any pattern, model, design, trademark, copyright or manufactured article protected by the laws of any foreign country, which registration, copyright, patent or otherwise," etc. It seems very evident that prior use by an American manufacturer does not constitute copying, imitating, republishing or reproduction and that there is nothing in this act which would prevent him continuing the manufacture and sale of articles and the use of trademarks and designs which were already upon the market before the exhibition of the foreign article. It is admitted that the intention of the legislators was not to cover cases of this kind and it is customary in legal interpretation to follow the evident intention of the framers of an act where the actual language admits of such construction. In this case it would seem that any other construction would be a violation of the language of the act as well as the intention of Congress in enacting the law, and we feel confident that the courts would so interpret this statute when it comes to be enforced, and that no wrong would be done to American manufacturers. Where an American manufacturer adopts a foreign design after it has been placed upon exhibit in this country he would evidently come under the provisions of this act, but where any trademark or pattern is of American origin or where an article has first been manufactured in this country, it could not fairly and could not technically or legally be maintained that he was copying the foreign product.

While there may be just objection to extending to foreign exhibitors greater protection than is given to American inventors and manufacturers, it seems as if the fear of such a drastic application of the law as has been outlined above is merely a bugaboo.

LIGHTING PICTURE GALLERIES.

How many of us have been annoyed, when viewing exhibitions of paintings, by the inability to find a viewpoint from which to observe a particular canvas with satisfaction! This is usually due to the fact that some source of light has been so placed that the light is specularly reflected to the observer at almost every position which it is possible for him to assume. In other cases there is no source which provides adequate illumination for the picture. These conditions are found not only in temporary exhibits, but also frequently in permanent installations in museums, art institutes, club rooms and public galleries.

It is consequently of interest to learn that an exhibition of pictures in Cleveland has received other treatment. The scheme used is described elsewhere in this issue. Not only has care been taken to avoid the annoying reflections above referred to, but all glare is avoided by having the lighting sources thoroughly screened from the observer.

In addition to these features, attention has been given to the color of the light. Operation of tungsten lamps above normal voltage gives light of unusual whiteness for general illumination, while particular pictures have their tones emphasized by the use of colored bulbs in addition.

Tables for 1914 Street Lighting.

The ELECTRICAL REVIEW AND WESTERN ELECTRICIAN has published for the year 1914 its customary tables for street lighting. These show in the usual tabular form the proper time for lighting and for extinguishing street lamps on the all-night schedule and the Philadelphia moonlight schedule. The total number of hours of lighting is given for each month and for the year for these two schedules and also for a simplified form of Frund's schedule and for the moonlight-midnight schedule, which can be readily derived from the published tables by simple rules which are given in the preface to the tables.

As usual the tables are printed on a sheet of convenient size, which forms an insert in a small booklet containing instructions and other useful information relative to these schedules. If desired, this sheet may be removed for mounting on a wall.

A copy of the lighting tables will be sent gratis to any subscriber requesting one. As heretofore, the price for additional copies and to others than subscribers will be ten cents.

Lynn Section Meeting.

On December 3, J. A. Orange, of the General Electric Company, gave a lecture and exhibition on the subject of nitrogen-filled tungsten lamps before the Lynn Section of the American Institute of Electrical Engineers.

The speaker was introduced by Elihu Thomson, who gave a historical summary of incandescent-lamp development, and paid a high compliment to present-day investigators who by the application of scientific principles to physical problems have made such great advance.

Mr. Orange described many methods and results of his work with vacuum lamps, covering investigations somewhat additional to the recently published papers on the subject, and those present were privileged to see a number of high-efficiency, gas-filled, tungsten lamps in operation.

On December 17 H. E. Clifford, of Harvard College, is to speak on "Sympathetic Vibrations with Some Electrical Applications."

Electric Club of Chicago.

A. A. Gray, general manager of the Electrical Review Publishing Company, delivered a very interesting address before the Electric Club of Chicago on December 4, his subject being "Developments in the Electrical Field During the Past Year." Mr. Gray commented on the important happenings in every branch of the industry and concluded with a glowing tribute to the activities of the Club. The statistics presented will be covered in a comprehensive review of the year which will be a feature of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for January 3, 1914.

Preceding the address of Mr. Gray, the election of officers took place, the slate as announced in our last issue being unanimously adopted.

Jovian League of Chicago.

At the weekly meeting of the Jovian League of Chicago on December 8 the report of the Nominating Committee was presented as follows: President, Homer E. Niesz; vice-president, E. H. Waddington; secretary, G. A. Freeman. Board of managers, George A. Hughes, Ernest Freeman, T. C. Ringgold, George C. Richards, W. R. Pinckard and Frank A. Ketcham. The report was signed by Sam A. Hobson, Victor Tousley and Pat Lyons.

Progress reports were presented by the committee chairmen in charge of the rejuvenation which will be held on December 15. It is announced that William N. Matthews, Jupiter, and Ell C. Bennett, Mercury will be the guests of honor on this occasion. The rejuvenation will be preceded by a banquet.

Society for Electrical Development.

The membership list of the Society for Electrical Development continues to show satisfactory progress, the total now numbering about 1,100.

Unusually strong letters endorsing the Society and its object have been received from Thomas A. Edison, Frank A. Vanderlip, E. M. Herr, Elihu Thomson, C. P. Steinmetz, and Theodore N. Vail.

The Society expects to reap great benefit as the result of the endeavors of a Central Campaign Committee, working from New York as headquarters, and co-operating with local committees in various electrical centers.

The New York Committee is composed of F. C. Bates, N. C. Rypinski, A. L. Doremas, George Williams, M. A. Oberlander, J. R. Strong, and H. H. Cudmore.

Mr. Cudmore, whose work in the field in behalf of the Society has been productive of excellent results, will visit the principal cities of the country during the next month to deliver a series of addresses on the society and its work.

At the present rate of progress it is believed that the society will begin its active campaign shortly after the first of the year.

Power Project on Mill Creek.

The Secretary of Agriculture has given a permit to James Lindsey of Portland, Ore., for the construction and operation of a power plant on Mill Creek, Douglas County, Ore., within the boundaries of the Siuslaw National Forest. Mr. Lindsey intends to transmit the power obtained from this hydroelectric plant 18 miles to Reedsport, where it will be used in the manufacture of pulp.

In connection with the power development, a rock-fill dam about 30 feet in height and 126 feet in maximum length is to be constructed at the outlet of Loon Lake, which has an area of about 265 acres. The power house is to be constructed with a concrete foundation, timber frame and sheet-iron covering. There will be installed three 1,150-horsepower, horizontal, Francis-type turbines, acting under a head of 263 feet, these being direct-connected to three 750-kilowatt, three-phase, alternating-current generators. The current is to be transmitted at 22,000 volts from the plant.

Census of St. Louis Electrical Employees.

The St. Louis League of Electrical Interests, Jovian Chapter, recently took a census of the employees in the electrical interests in St. Louis. About 75 per cent of the total number of electrical concerns in the city were willing to furnish the necessary data. The figures secured were as follows:

Male employees, 13,311.
Female employees, 1,839.
Total, 15,150.
Number of dependents, 32,832.
Number of concerns complying with request for information, 72.

St. Louis League Learns About Western Electric Laboratory.

About 150 members of the St. Louis League of Electrical Interests (Jovian Chapter) attended the weekly meeting of that organization held in the Missouri Atheltic Club room Tuesday evening, December 2, and were highly entertained by E. B. Craft, development engineer of the Western Electric Company, New York, who delivered a very interesting address, illustrated by lantern slides, entitled "Problems and Methods Involved in the Making of Modern Telephone and Telegraph Equipment."

Philadelphia Jovians to Have a Theater Party.

The Philadelphia Jovian League will give a theater party at the Broad Street Theater, Philadelphia, on Thursday evening, December 18. "The Ghost Breaker" will be the attraction.

Electricity in Cord and Rope Mills.

The use of electric motors in cordage and rope mills has been the means of increasing production from two to ten per cent, depending on the efficiency of the installation. Operating data on several typical mills purchasing power are given in this article together with a discussion of the general features of mill electrification.

Disregarding the question of greater economy in manufacturing, which, of course, is of paramount importance in any industry, there are several advantages of electric drive that apply specifically to cordage and rope mills, any one of which is of sufficient moment to justify the adoption of this form of power in such establishments.

One of the important advantages of electric drive, when power is purchased from the central station, is its reliability. In a cord or rope mill the continuity of the processes involved makes reliability of driving of prime importance, as a breakdown in any department would affect the entire plant. Little stock is accumulated at any stage of the operation, each department depending upon the previous one for its supply.

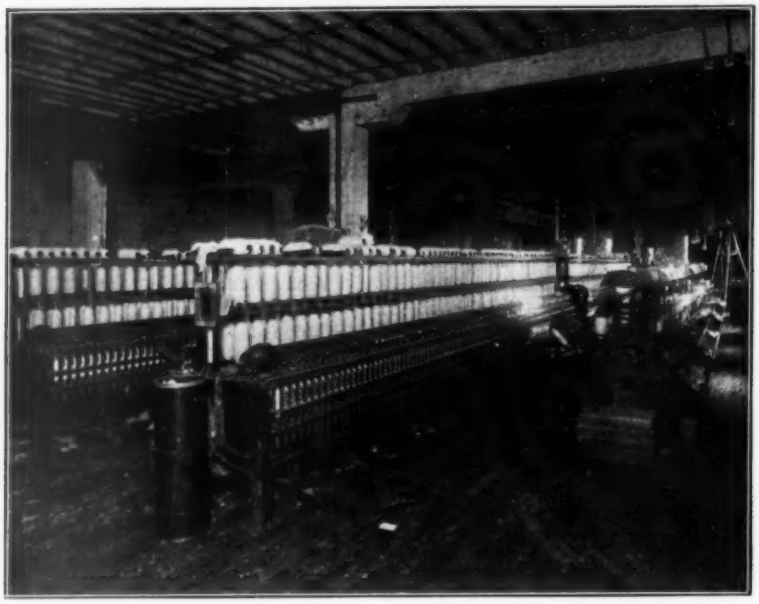
Next in importance is the flexibility of electric power. Whereas the mechanical system of drive offers but limited facilities for enlargement, with motor drive, using central-station service, an extension or extensions to the mill can easily be made without any changes in present driving arrangements or without shutting down any part of the plant. Thus in installing electric drive no provision need be made for more than the immediate requirements.

In a mill converted from steam to electric drive, one of two results is always brought about. If the original production is maintained the amount of power necessary is reduced. This should not in all cases be regarded as of paramount importance, the most vital advantage being an increased product from the mill, which it has been shown can be obtained through electric drive.

In mills only very roughly converted, where surplus power is taken, and where the old uneconomical arrangement is left intact so that the steam drive may be used if desired, all carefully kept records show that an increase of production of from 2 to 10 per cent is obtained. In new mills, especially constructed for electric drive, the higher of these figures should obtain. This increase is brought about by two things. First, proper balancing of the work, and next, the application of motive power directly to the work it is to drive, and the fact that this motive power has a constant speed value, both instantaneously and continuously.

The importance of production may be shown in a broad, general way as follows. The value of a mill's product per annum is about equal to its capital investment. The cost of manufacture, with many variations for the class of work,

Group of 65 Braiders Driven by 60-Horsepower Motor—Puritan Cordage Mills, Louisville, Ky.



Group of Spinning Frames Driven by 30-Horsepower Motor—Puritan Cordage Mills.

may be taken proportionately about as follows: Cotton, 60 per cent; power, 4 per cent; all other costs, 36 per cent; and the power cost, as a total, is from 3 to 6 per cent of the total market value of the product. Thus, assuming the cost of a 5,000-spindle mill as $100,000, its product in a year will be worth, roughly, $100,000, and its power bill, say $5,000.

If the product of this mill could be increased 10 per cent the gross value of this increase of product would be $10,000, of which the only cost would be cotton, power and some labor. The most costly operations of labor are paid by the day and effect no increase.

On account of the steadiness of the speed of the electric drive the machinery will suffer less deterioration than if run at even lower speeds with the steam drive.

It is very proper and very necessary to take all of these points into consideration as having a direct bearing on the cost of steam power.

In addition to the foregoing advantages of motor drive, the ease of control is important, owing to frequent stoppages of machines, pickers especially, for replenishing the stock.

Summarizing, the advantages of motor drive, using purchased power, are: (1) Reduction in capital expenditure, or an equivalent increase in production with the same expenditure. (2) Steadier speed at all loads due to the larger generating sets employed by central stations. (3) Reliability of supply, insured by emergency units in the power station. (4) Freedom from the necessity to watch the coal markets and keep in touch with the improvements in steam plant. (5) Freedom to make extensions or alterations and to operate overtime in any or all departments at a cost proportionate to the power used. (6) Cleanliness, improved lighting conditions. (7) Greatly reduced fire risk.

Cycle of Operations.

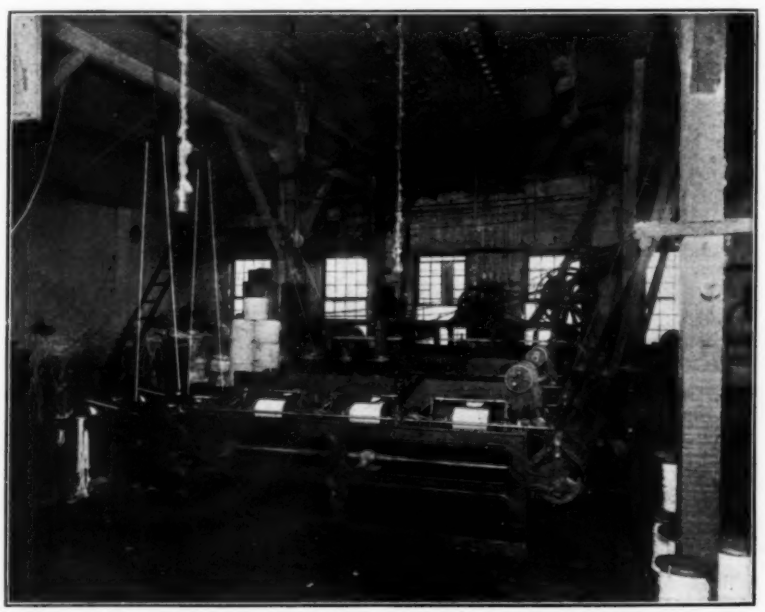
The preliminary operations in manufacturing cord and rope are exactly the same as in a cotton mill, up to the point of spinning. First, the raw cotton from the bales is drawn, usually by means of a suction conveyor, to the picker room. In the opener and breaker picker the cotton is beaten, the fibers loosened and the material converted from a dense matted mass into a light flakey one. During this operation, also, much of the dirt and sand is removed from the cotton. The fiber then passes to the intermediate and then to the finishing pickers, each of these machines again beating the cotton, cleaning it and finally passing it to perforated screens which compress the fiber and deliver it as a lap which is formed into a roll.

The carding room is the next department into which the cotton is taken. The rolls from the pickers are placed on the cards where the fibers are drawn approximately parallel by a combing process. The stock enters these machines as a sheet of lap and is converted into what is called sliver, a round string-like mass about one inch in diameter.

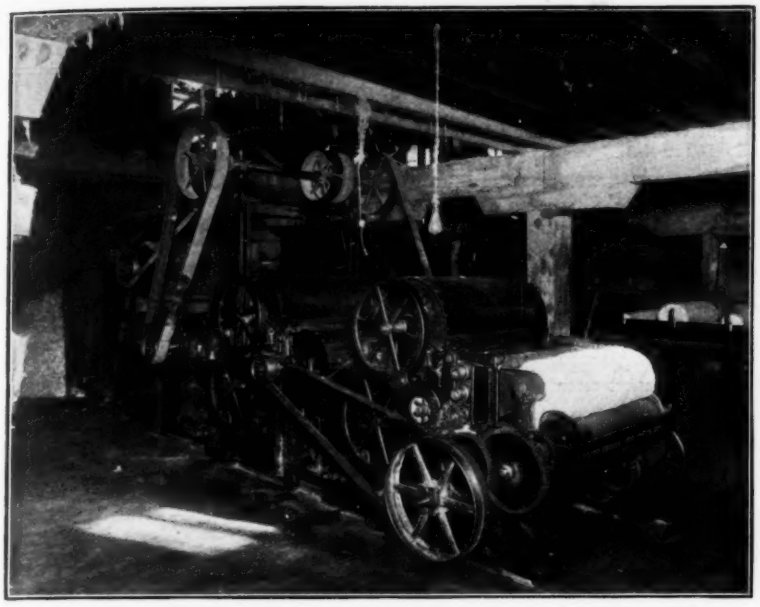
Drawing is the next operation, the drawing frame receiving the sliver from either the combers or cards. This machine simply carries on to a greater degree the operation of drawing the fiber parallel. In this machine, however, several ends of sliver are fed between sets of drawing rolls and are drawn out into a single sliver approximately equal in dimensions to the sliver fed into the machine.

The first twist given the yarn is on the slubbers. Sliver from the drawing frames passes to the slubbers, which are equipped with drawing rolls and spindles, upon which bobbins are revolved, winding the drawn and slightly twisted stock. The slubbing, which is the name of the product as it leaves these machines, is then taken to the roving frames, where it is further drawn out, twisted and wound on bobbins.

The final preparatory process is spinning and the capacity of a mill and the grade of its product depends upon these machines. On the spinning frames the yarn is still further drawn out and given



Two Rope Machines and Four Formers Driven by 25-Horsepower Motor.



Opening Breaker and Picket Driven by 35-Horsepower Motor—Puritan Cordage Mills.

its final twist. Spinning is accomplished by either ring or mule frames. In the Southern mills ring spinning is almost exclusively employed.

From the spinning room the yarn is taken to the braiders where the twine or rope is formed, then to the twisting machines and finally to the finishing and hanking machines.

The foregoing outline gives a general idea of the processes involved in cordage and rope-mill operation. The requirement of each of the drives referred to are such as to render electrical operation highly advantageous.

General Power Requirements.

It is not feasible to give any specific figures on the power requirements for cordage and rope mills, since in no two installations is the selection and arrangement exactly the same.

Pickers are perhaps the largest individual power users in a mill. The horsepower required to drive depends upon output and whether the machine is a single or double-beater picker. From 4 to 6 horsepower is usually applied to pickers. These machines are usually idle about 25 per cent of the time.

The power requirements of slubbers vary with the number of bobbins, but average about two horsepower per frame. About 10 per cent is allowed for stoppage time.

It is hard to specify the power requirements of spinning frames, as so many items have to be taken into consideration, such as speed of spindles, tightness and character of spindle band, humidity, temperature, character of stock, etc. Generally about one horsepower per 70 spindles is taken as an average figure. An allowance of about 10 per cent usually is made for stoppage.

Group and Individual Drive.

There is considerable difference of opinion between mill engineers as to the relative merits of group and individual drive. Excellent examples of both classes of drive are in existence but the difference between mills makes accurate comparison of the two systems impossible.

The picker drive was originally installed on the group system. The next step was to use individual motors belting directly to the pulley on the countershaft of the picker. This latter drive has many advantages over group drive but it too is being superseded by direct motor drive. In this drive the rotating element is mounted on the picker shaft pulley fashion, the stationary portion being attached by a suitable bracket to the picker.

For driving carding machines group drive is almost universally used, the practice being to install one motor to drive as many as 75 machines. Should individual motors be applied to cards they would have to be slow-speed machines and while, from an operating standpoint, excellent results could be obtained, the cost of installation would be almost prohibitive.

Group drive is used largely for drawing frames, although recently motors are being applied directly to the frames with excellent results. The usual practice is to drive three or four frames from one overhead belt by means of a countershaft located beneath the frame, with a pulley for each frame and a receiving pulley for the end. Individual motors with chain drive are usually preferred. Braiding machines and twisters are always arranged for group driving. Finishing machines and polishers are usually driven by individual motors as these are used only part of the time.

per cent is usually made for stoppage. be found the detailed motor installations in three typical mills purchasing power.

Electric Power for Tokio.

At a recent meeting of the Japanese cabinet a loan of $8,000,000 was sanctioned for the purpose of constructing a government electrical plant, and it was decided to float a foreign loan in the spring for this purpose.

Four Twisting Machines Driven by 25-Horsepower Motor. Braiders also Driven by this Motor.

Cord and Rope Manufacturing Data.

The term load-factor is used in these data in such a sense that a load factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Cordage and rope mill located in Louisville, Ky., manufacturing sash cord and rope. The average output of the plant is 60,000 pounds of rope per month. Plant operates 60 hours per week.

Total connected horsepower, 210. Total number of motors installed, 9. Average kilowatt-hours per month, 21,561.

Kilowatt-hour consumption for 12 months: January, 24,380; February, 22,450; March, 24,410; April, 24,750; May, 20,360; June, 19,460; July, 20,000; August, 21,920; September, 19,870; October, 21,910; November, 18,660; December, 20,570.

Load-factor, 19 per cent; operating-time load factor, 40 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	35	1,120	Belted to a short line shaft driving one breaker picker; and one finishing picker.
1	35	1,120	Belted to line shafting driving 15 cards; and four drawing frames, six deliveries each.
1	30	1,120	Belted to line shafting driving six spinning frames, 240 spindles each; five slubbers, 44 spindles each; and two spoolers, 120 spindles each.
1	25	1,120	Belted to line shafting driving 65 braiders, 12 spindles each; and four twisters, 30 spindles each.
1	40	1,120	Belted to line shaft driving 60 braiders, 12 spindles each.
1	25	1,120	Belted to line shafting driving two rope finishing machines, one four-ply and one three-ply; and four formers, 90 spindles each.
1	10	1,800	Belted direct to one rope-polishing machine.
1	5	1,120	Belted to short line shaft driving four hanking machines.
1	5	1,800	Driving machine-shop equipment.

Cord and rope mill manufacturing sash cord and clothes line exclusively.

Total connected horsepower, 160. Total number of motors installed, 6. Average kilowatt-hours per months, 12,074.

Kilowatt-hour consumption for 12 months; November, 12,830; December, 13,770; January, 12,370; Febuary, 13,070; March, 11,760; April, 14,049; May, 12,580; June, 10,760; July, 10,730; August, 11,230; September, 11,430; October, 10,310.

Load-factor, 14 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	15	1,120	Belted to a line shaft driving one single-beater opener picker; one intermediate picker; and one finishing picker.
1	20	1,120	Belted to a line shaft driving 20 cards.
1	30	1,120	Belted to a line shaft driving six draw frames, six deliveries each; five slubbers, 44 spindles each; and two slubbers, 60 spindles each.
1	20	1,120	Belted to a line shaft driving seven spinning frames, 228 spindles each; and two spoolers, 120 spindles each.
1	50	900	Belted to a line shaft driving 120 braiders, 12 spindles each; and four twisters, 30 spindles each.
1	25	1,120	Belted to line shafting driving four rope formers; two four-ply rope machines; and one polishing machine.

Twine mill manufacturing heavy wrapping twine. The average weekly output is 18,000 pounds operating 120 hours per week.

Total connected horsepower, 140. Total number of motors installed, 3. Average kilowatt-hours per month, 24,702. Kilowatt-hour consumption for 12 months: October, 25,510; November, 23,220; December, 24,340; January, 25,450; February, 21,500; March, 21,730; April, 20,900; May, 24,270; June, 27,490; July, 26,520; August, 21,550; September, 23,910.

Load-factor, 32 per cent; operating time load-factor, 34 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 2,200 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	60	720	Belted to line shafting driving one opener breaker and picker; one finishing picker; 14 cards; four six-delivery draw frames; two slubbers, 40 spindles each; and four spoolers, 120 spindles each.
1	40	900	Belted to line shafting driving six spinning frames, 240 spindles each; and 60 braiders.
1	40	900	Belted to line shafting driving 60 braiders, 12 spindles each; and four twisters, 30 spindles each.

Commercial Practice
Management, Rates, New Business

A TWO-RATE TARIFF SYSTEM WITHOUT TIME-OPERATED CONTROL.[1]

By H. H. Perry.

It is only within the last few years that electric heating and cooking have been energetically brought to the knowledge of the consumer by supply authorities. The reason for the tardy introduction no doubt lay in the untrustworthiness and poor efficiency of some of the apparatus. Vigorous efforts by manufacturers, however, have now opened up an entirely new field.

In T. P. Wilmhurst's paper[2] it was shown that there were three different periods at which a peak occurred for heating, and the chart areas of those peaks on the load curve were not appreciably dissimilar. One of the peaks coincided with the lighting peak.

A similar and perhaps more striking instance is afforded in the case of Luton, where the claims of electric heating and cooking are afforded full scope. For the past year the output has risen from 2,979,000 to 4,542,000 units (kilowatt-hours), a 52-per-cent increase, and the load-factor from 19.7 to 20.9, *i. e.*, a 6-per-cent increase, under the "Point Five" tariff. As in the case of Derby, three heating peaks occur each day, the highest being at midday, while the Sunday load is a valuable one.

If, therefore, the average diversity-factor is such that the heating peak loads can be ignored, the problem still remains of basing the high-rate charges on the lighting only. It seems ridiculous to charge at certain times of the day a low rate for power and another rate for lighting for the dual supply, and further, it is equally absurd to exact the full penalty price from a consumer when he is using only a fraction of his maximum lighting load, assuming for the moment that no heating is in use.

In none of the papers which have been read before the Institution in recent years on the subject of tariffs is any suggestion made that the price charged for domestic lighting should, at any period of the day, approach or equal that charged for power except during restricted hours.

The object of this paper is to show: (1) that the use of electricity can be extended, with advantage both to supplier and consumer, by granting facilities to the latter for using his lighting circuits during "off-peak" hours at a low-rate charge; and (2) that the multiplication of domestic power circuits, while being an advantage, is not always necessary for securing a low-rate charge.

A simple change-over switch, automatically rocked, can combine or separate the two rates at will. Such a method needs two meters and therefore resolves itself into a two-rate system.

Up to the present, two-rate clock or centrally controlled systems have not made great headway for the following reasons: (1) the high cost of meters (clock controlled); (2) expert workmen are required for clock repairs; (3) monthly winding; (4) prolonged period of testing. And in the case of central control by a system of mains because of (5) high initial outlay; (6) cable faults.

There is another form of two-rate meter with two sets of train wheels alternately geared to a single meter and controlled by a series solenoid energized by the lighting-circuit current. This was patented as far back as 1898, and made by the British Thomson-Houston Company, but I understand that its manufacture has been discontinued. It is obvious that such conditions can only apply to motor meters.

In all the above methods of operation, it is not possible to register on both rates simultaneously.

But why go to the expense of any of the above systems in order to change a consumer's meter over from the high rate to the low rate when a magnetic change-over switch will automatically do this?

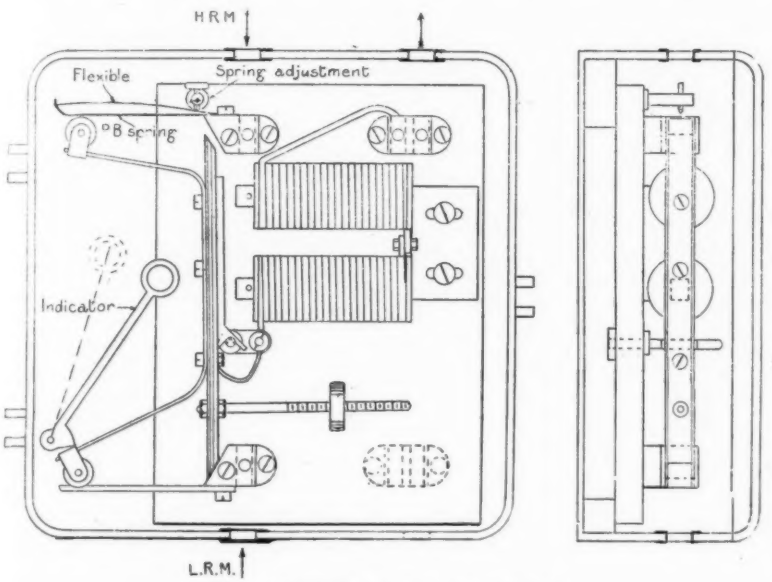


Fig. 1.—Diagram of Change-Over Switch.

Description of Switch.

As shown in Fig. 1, an ordinary single-pole change-over switch is employed, one arm of which is magnetically attracted by the lighting-circuit magnetizing current. It is freely pivoted about its center and a balance weight is provided on the other arm, the position of which is adjusted to give any proportion of the consumer's lighting between, say 5 per cent and 25 per cent at the low rate. In isolated cases it may be practicable to give a higher percentage.

Auxiliary contacts are provided for

1 A paper (slightly condensed) read before the Manchester (England) Section of the Institution of Electrical Engineers, November 18.

2 *Journal*, Institution of Electrical Engineers, London; Vol. 51, p. 180, 1913.

maintaining continuity of the circuit when changing over; without these, the practical everyday working of the switch would be impossible. No mercury cups are used.

The switch is normally on the low-rate side, and two of the ordinary stock pattern of meters are employed, a practice which is daily becoming more common for domestic circuits owing to the demand for power.

The connections shown in Fig. 2 would be used for a consumer taking practically all his current for lighting, no separate circuit being provided. All the current passes through the high-rate meter (*H.R.M.*), or the low-rate meter (*L.R.M.*), and the switch is adjusted by the balance weight or by the air gap so that all currents less than a given fraction of the maximum current (5 to 25 per cent) are registered on the low-rate meter.

A separate power circuit is used in Fig. 3, connected to the switch as shown, and two meters are therefore necessary under ordinary tariff conditions. The low-rate meter will therefore register the whole of the power load, and up to 25 per cent of that required by the lighting, when the switch is on the low (or left-hand) side. When the switch is on the high (or

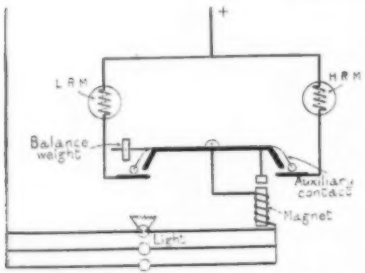


Fig. 2.—Connections for Lighting Circuits.

right-hand side, *L.R.M.* will meter the power only, and *H.R.M.* only the lighting. Both in this case and in Fig. 4 the meters are required to operate simultaneously.

In Fig. 4 the consumer has the option of these connections provided certain heating apparatus, such as a complete cooker, a system of radiators, or other power, is adopted, whether purchased outright or hired.

So long as the heater system is in use, *L.R.M.* will meter all power and any desired proportion of the lighting, since the pull of the magnet is neutralized to the required extent. Otherwise the operation is the same as in Fig. 3; that is to say, the lighting reverts to *H.R.M.* after 5 to 25 per cent has been exceeded.

To provide equal and opposite magnetized ampere-turns with equal current flowing in each circuit would court financial ruin if the heating system were maintained over the lighting peak; it is probable, therefore, that the opposing forces would generally be designed so as not to have a greater ratio than 1 : 2, or even as low as 1 : 4, until heating apparatus reaches a very much higher point of efficiency and commands a ready sale to every consumer.

Provided always that the heating

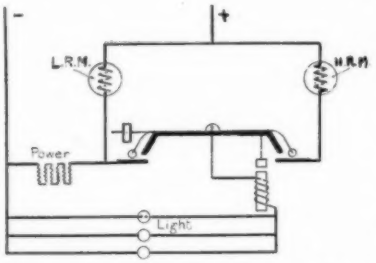


Fig. 3.—Connections for Separate Power Circuits.

peak, assuming that there is one only, does not coincide with the lighting peak in magnitude and length of time, the arrangement of Fig. 4 should undoubtedly prove acceptable. The mere granting of a low flat rate for power by many authorities today is an admission that the diversity-factor is large enough to allow the coincidence of double peaks to be ignored. It has the immense advantage of giving to the consumer the facilities for using dozens of forms of really useful appliances (together with light) from the existing lighting circuits at a low rate, and the load so provided should do much to improve the load-factor, especially during the summer quarter.

In a two-rate system it may be urged that the cost of two meters is excessive, especially for the small consumer, who does not, and is unlikely to, use any power, and is therefore connected as in Fig. 2. The answer to that point is that if such a consumer can (by the setting of the auto-switch) save say 10 per cent on an annual bill of $25, he would agree to pay a small additional rental for a second meter. If a consumer is connected as in Figs. 3 or 4, two meters are already necessary, and no additional expense is incurred.

There is nothing in this system to prevent the retainment, or imposition, of the primary charge on the tariff, and it has been suggested that the cost of the auto-switch (about $4.30 for the ampere size) should easily be borne by the consumer in rental, or the tariff made to include it. There are many cases of "necessitated" lights, i. e., those which are the first to be switched on and the last to be switched off, and which ought to be distinguished from occasional lights. As already pointed out, it seems misleading to charge a consumer an apparent high rate on these; I say "apparent" because he has little chance of ascertaining his real rate for these on the maximum-demand or primary-charge systems. To give an instance: it is highly probable that a number of consumers would burn one or more lights throughout the night as a protection against burglarly, providing that the cost were small and readily checked.

If heating by electricity is to be made familiar and profitable, it is a sine qua non that a hiring department be inaugurated from the commencement—not only from an introductory point of view, but as an educative agency always at the service of the consumer. It is well known to engineers that a watchful eye is generally needed for undersized plug circuits when heating appliances are in use.

Before concluding, it may be useful to revert to a few points in connection with the device, the working of which I have already explained.

1. The well known effect of residual magnetism has prevented many devices in which instantaneous action is required for a small change in the current from being placed on the mar-

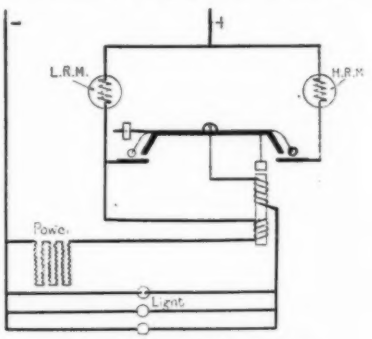


Fig. 4.—Composite Connections.

ket. In the present case a much larger electromagnet than is ordinarily required is provided, and the air gap is increased with but negligible magnetizing loss. The armature will rock to and fro with a change of only 0.3 ampere for a 10-ampere instrument. The magnetizing loss at full load is approximately 4 watts with continuous current and 8 to 10 watts with alternating current.

2. The auxiliary contacts never have to carry more than 25 per cent of the lighting load, except when the arrangement of connections shown in Fig. 2 is employed and a large power load is carried, which is most unlikely. Both contacts are, however, designed to carry full load, so that continuity is assured; the top one only is provided with a flexible phosphor-bronze spring which tends to give the consumer the benefit of resisting the connection with the high-rate meter.

3. Both auxiliary contacts are fitted with rollers, which relieve friction and tend to revolve with each rock-over motion. They are so pivoted that the break in the circuit, as the position of equilibrium is approached, is as short as possible. The inductive spark due to the magnetizing current is then negligible.

4. A simple indicator, governed by the magnetizing current, shows the rate in use. The balanced weight can, if required, be sealed against fraudulent adjustment.

5. The complete switch in a sealed case measures 7 by 7 by 2.5 inches.

Whatever novelty may be claimed for this system I consider that it has at least the advantages of simplicity in working and a clear indication of the charges to be met by the consumer; the latter advantage I feel certain will be readily appreciated by him.

The reduction offered to consumers, whether taking power or not, is an inducement somewhat similar to that inaugurated by gas undertakings, and the increased business resulting would do much to reduce the standing charges.

Woolen Mills Purchase Power.

A typical example, showing that the manifold advantages of electric power frequently outweigh the consideration of economy which is often advanced, is that of the Sweetwater (Tenn.) Woolen Mills. This company, which contracted for current from the Ocoee River hydroelectric plant of the Tennessee Power Company, has been using it for several months, and reports that while the cost has been about as great as if steam had been used, the other advantages were so marked that the interests controlling the mill are considering putting electricity into their plant at Rossville, Ga., operated under the name of the Parks Woolen Mills.

Still another feature of interest, suggesting that the central station can frequently secure part, if not all, of the power load, was that the Sweetwater plant had found it would be necessary to add to its boiler equipment if it were to continue to use steam power, and the use of electricity eliminated the necessity for this. Its boilers are now used for making steam for drying and dyeing purposes exclusively.

White Way in Rockland.

The town of Rockland, Mass., celebrated the opening of the new "White Way" on December 3. The streets have been illuminated with incandescent lamps, installed on arches over the main business street, a half-mile in length.

Electricity in the Store.

An attractive 16-page pamphlet with the above subject has been issued by the Commonwealth Edison Company, Chicago, to stimulate its proposition of renting lighting fixtures for stores. The pamphlet has been cleverly prepared and sets forth convincingly some of the advantages of electric lighting. The details of the rental proposition are made clear and the fixtures are briefly described and illustrated; a sketch showing a typical installation of each fixture is included. Near the end of the booklet is shown a graphical demonstration of the electric light now available for one dollar compared with that which could be purchased seven or eight years ago; this shows a striking nine-fold increase in that short period.

The rental contract covers 24 consecutive months and provides not only hanging and rental of the fixure and lamps, but renewal of lamps and a thorough cleaning of both lamps and fixtures every ten days. Interior fixtures in stores already wired are rented at 50 to 62.5 cents each per month. If the store is not wired, the company will do the wiring, install the complete fixtures, maintain them at twice the above monthly charges. After expiration of the first two-year period, the contract can be renewed for another two years, at 50 to 62.5 cents per month per fixfure, depending on the type and size of fixture installed. In each case the contract can be terminated on purchasing the fixtures, a special discount being given for purchases of 12 or more fixtures. Ornamental cluster street-lighting equipment of the standardized "Chicago Beautiful" type is also installed and rented at $2.00 to $2.37 per week, depending on the number of hours of lighting contracted for. Mazda tungsten lamps are used for both inside and outside lighting in all cases.

The interior fixtures obtainable on these rental propositions are all of simple design and inexpensive. They are suitable for a variety of stores where an abundance of light at low cost is desired and where artistic effect is not sought. However, from the standpoint of illuminating engineering and bearing in mind what can be accomplished with simple, but carefully designed and utilized equipment, some of the fixtures are open to considerable criticism, particularly those shown on pages 10 and 11 of the pamphlet in question. If installed in a very high room and close to the ceiling they would not be so objectionable, but the statement is made that the stemless cluster fixture shown on page 11 is designed for low ceiling conditions; the cut shows clear 60-watt tungsten lamps in use and a reflector that is almost perfectly flat and that therefore scarcely screens the lamps at all. The flare from such a unit is very pronounced. The lower cut on the same page shows one of these flat stemless fixtures installed in a low window. Such window lighting is acknowledged by all who have studied the question to be very poor practice, the object of window lighting is to illuminate the goods displayed and not to show the lamp conspicuously exposed, in fact, the best results are obtained when the lamps can not be seen at all. The installations shown on pages 13 and 9 are almost as bad and contrast strikingly with the handsome show window depicted on the cover of the booklet in which no lamps are visible.

British Municipal Central Station Insist on Exclusive Supply.

Isolated-plant owners are sometimes prone to object to what they term a high-handed practice on the part of central-station companies of insisting on supplying all the energy needed in a plant or none. That this practice is being used by a municipal plant is shown in the following note from our London contemporary, *Electrical Engineering*. The case is particularly noteworthy because it involves two public bodies.

Some dissatisfaction is being expressed in the local papers of Aberdeen, Scotland, at the alleged attempt of the Corporation with regard to an application by the Aberdeen Royal Infirmary for a supply of electrical energy for driving laundry machines. The Infirmary has its own electric power plant but, in order to avoid extending it, applied to the Corporation for the necessary current to drive the new laundry machines. Although the terms proposed by the Corporation have not been made public, it is stated that they practically impose upon the Infirmary the necessity of scrapping the existing plant and taking all power from the Corporation.

Central-Station Power for Printing.

The extent to which the electric motor is forcing out the gasoline engine in the smaller towns is suggested by the number of installations being made by newspapers in the cities which have only recently enjoyed 24-hour service from the central station. The Somerset (Ky.) *Journal* is now getting power from the plant of the Kentucky Utilities Company in that city, having relied on an engine operated with gasoline for power heretofore. A number of small job printing shops in that section, which have used hand power because of the lack of electricity and the expense and inconvenience of other forms of power production, will also electrify.

Electrical Construction

PRACTICAL METHODS IN THE INSTALLATION OF CONDUIT IN TERRA COTTA.

By G. N. McCarthy.

When erecting conduit to a panel box that is to be installed in a terra-cotta partition, the conduit runs should be brought to a point approximately above that which will be occupied by the panel box. In many cases the partition is in place at the time it is necessary to erect the conduits to this point, so that the wireman must locate the point approximately and bring his conduit lengths down, as indicated in Fig. 1, to a point somewhat above that which will be occupied by the panel box. If the brick masons have located (but not built) the terra-cotta partition, the exact point where the panel box is to set can be determined; then, each length of conduit fitting into the box is lengthened out, as indicated at *A*, Fig. 1, the box is put in place, and held temporarily until the terra cotta is built around it.

The plaster is applied directly on the terra cotta, and the box is so set as to be flush with the finished surface of the wall. The wireman must allow for this in locating his boxes. Often the

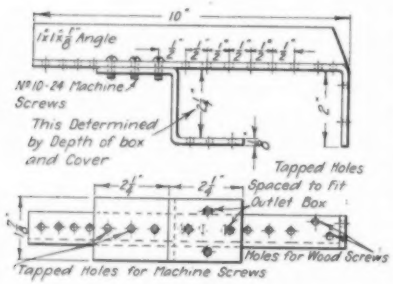


Fig. 2.—Switch-Box Support.

lengthened-out conduit coming into the box from above and below would serve to hold it in position until the terra cotta is built around it. However, masons that build the partition are often very careless, and will push the box out of their way in order to save cutting the terra cotta. It is, therefore, very desirable to brace each box rigidly with timbers extending to the ceiling above, to the floor, or to the columns, so that the box cannot be thrown out of its proper position by masons when they are doing their work. It is also a good plan for an electrician to be on the job when the partition is being built.

The procedure in erecting concrete buildings with terra cotta partitions usually consists in the building up of all the columns, the floors, and the

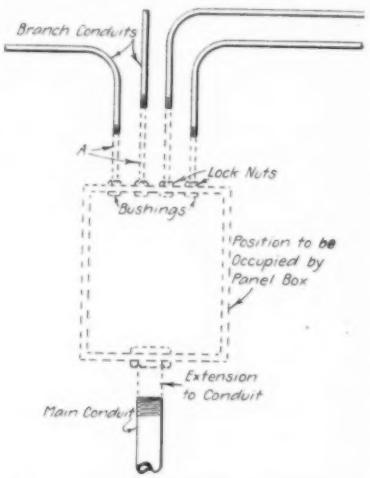


Fig. 1.—Lengthening Out Conduit to Reach Panel Box.

outside wall as rapidly as possible, before any partitions are erected; after the outer shell, as described above, is in place, the partitions are built in. The conduit runs that should lie in the finished partitions shall always, of course, be installed before the partitions are built, and the panel box, switch and outlet boxes are located at the proper points in these vertical column runs.

It is almost imperative that a wireman be on the job when the partitions are being built to see that the masons properly inclose the conduit, outlet, switch and panel boxes. If the masons are left to themselves, they will, very often, if they can, push the conduit run entirely out of its intended position, and build the partition up, leaving the conduit lines and box on the outside. When this occurs, it is necessary to cut channels and holes in the terra cotta, push the conduit lines and fittings back into the wall, and then plaster around them.

Locating a Swith Box.

A device for accurately locating a switch box at the side of a door opening, where the switch box is to be installed in terra-cotta partition, is illustrated in detail in Fig 2, and the method of its use is shown in Fig. 3. Switch boxes must often be located accurately because of the limited amount of space available. Frequently, there is only three or four inches between the edge of the trim around the door opening and the paneled window in the partition. Switch boxes must, also, be so set, prior to the erection of the terra-cotta partition, that the switch when installed will be absolutely vertical. Architects and owners will notice a switch plate out of plumb on a job where there is nothing else to which they can take exceptions. Hence, the importance of this feature to the electrical contractor, or wireman, is apparent.

Fig. 3 shows the switch-box support held in position on the door buck set in the partition. It will be noted that the support is held to the buck by two, three or four wood screws, which secure it to the switch box that it carries with sufficient rigidness so that the masons erecting the terra cotta are not apt to displace the box. Referring to Fig. 2, the L-shaped piece on which the switch box is to be carried, can be adjusted longitudinally on the

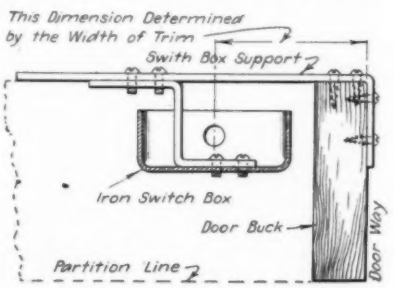


Fig. 3.—Use of Switch-Box Support.

angle iron to provide for different distances of center of switch box to door line. The four holes in the L-shaped piece are tapped for No. 10-24 machine screws, screws of this size being used almost invariably for supporting the fixture studs in outlet boxes. The three screws which hold the L-shaped piece to the angle iron are of the same size (No. 10-24) so that if the wireman loses any he can readily replace them with fixture stud screws, which are always available.

Height of Boxes.

A device for accurately determining the elevation for all of the switches on a floor of a building is illustrated in Fig. 4. Its application is shown in Fig. 5. It is very important that the heights of all of the switch plates on a given floor be the same, but this is a condition that can not be readily satisfied—unless one knows how—because the switch outlet boxes, hence the switches, are often located before the final floors, or possibly the partitions, are in place. Inasmuch as a switch plate is usually but a short distance above the door knobs, and the door knobs are uniform in height, a very superficial inspection will indicate when one switch is higher than another. This is another feature of the wiring installation that any architect or owner can readily criticise if it is not right. With the method suggested in Fig. 5, the uniform elevation of all of the switch plates on a floor can be determined with accuracy. The device (Fig. 4) consists merely of a piece of rubber hose, possibly 30 or 40 feet long, having a half-inch glass tube, about 2 feet long, inserted in each of its ends. After the wireman has located the switch height for one switch box, the rubber hose is almost filled with water.

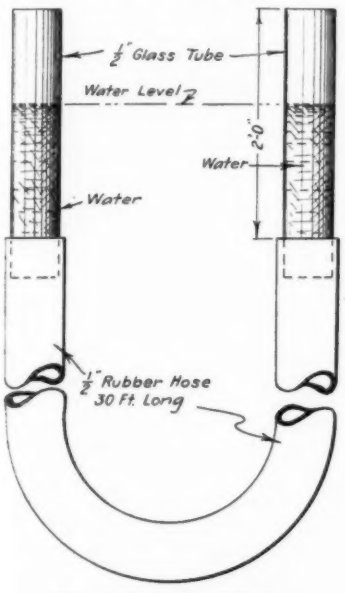


Fig. 4.—Leveling Device.

The method of using this "rubber-hose level" is as follows. The wireman first determines the correct height for the switch at one door buck, and indicates on the buck with a pencil mark this elevation. The two glass tubes in the ends of the rubber hose are then brought together as indicated in Fig. 4 and water is poured into the hose until the level of the water in the tubes is at the height of the mark on

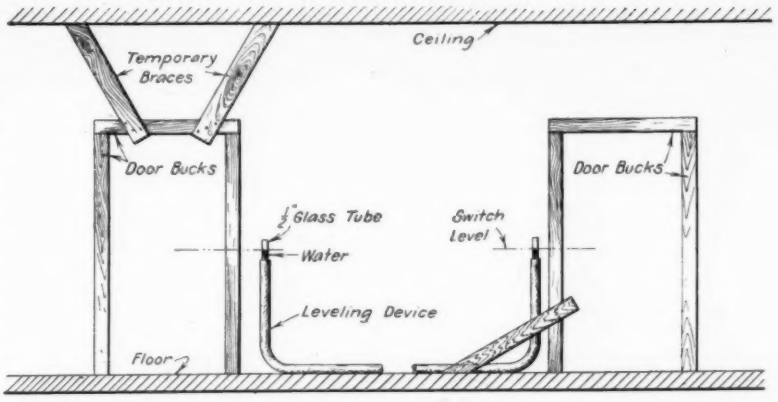


Fig. 5.—Use of Leveling Device for Determining Height of Switch Boxes.

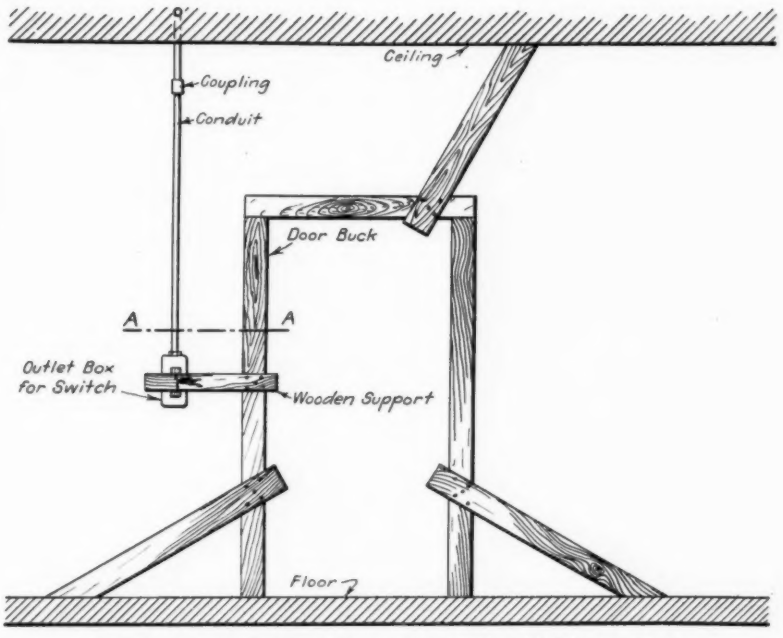


Fig. 6.—Supporting Outlet Box to Door Buck with Wooden Cleat.

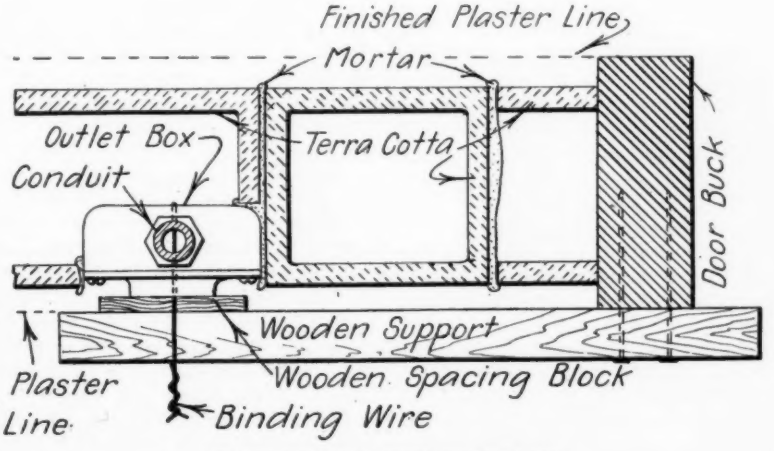


Fig. 7.—Details of Support for Outlet Box.

the index door buck. A piece of tape is then wrapped around each of the tubes indicating this correct level. One glass tube is now held at the door buck having the switch elevation marked on it, so that the tape mark on the tube is on a level with the mark on the door buck. The water may now either be above or below this tape mark. The other end of the tube is taken to an adjacent door buck where a switch is to be located, and the end of the tube containing the glass is raised or lowered until the water level in the tube just reaches the tape mark on the tube. A mark is made on the door buck at the level of this tape mark, and the switch should be installed at the elevation of this mark.

Supporting the Outlet Box.

A rough-and-ready method of supporting a switch outlet box at a door buck is shown in Figs. 6 and 7. A piece of plank is nailed to the door buck, extending outward at the side where the switch box is to be located. The switch box is then wired to this plank as shown. It may be necessary to insert a spacing block between the stick and the outlet box cover as shown in Fig. 7. The conduit that is to serve the box is so erected so that the arrangement appears as shown in Fig. 6. The terra-cotta masons then build a partition of tile around the box as indicated in Fig. 7. The wooden stick serves to hold the box in place while the masons are constructing the partition. If the spacing block has been selected of a correct thickness, the outlet box should set just within the face of the terra-cotta tiles after the tiles are in position. The wire (which should be of ordinary soft iron, ungalvanized) that holds the box to the stick, passes through the holes in the rear of the box, and is twisted tightly as indicated, drawing the box snugly against the supporting stick.

Ungalvanized iron wire is preferable to galvanized for holding the box because the action of the mortar used in setting the tile corrodes it, and renders it easily broken off after the partition has been completed.

St. Paul Jovians Will Decorate Christmas Trees.

A club of men in St. Paul, Minn., known as the Goodfellows, has planned a Christmas entertainment for the poor children of the city, and has called upon the St. Paul Jovian Chapter to take charge of the decorations. The Jovians took the matter up and appointed a committee, of which Russell H. Eddy is chairman, to take charge. The different electrical interests of the city were canvassed and donations obtained of festoons, lamps, dipping compound, feeders, etc.

INCREASING THE EFFICIENCY OF THE ELECTRICAL CONTRACTOR'S SHOP.

By William E. Rhodes.

In a great many electrical contracting shops throughout the country, there exists a method of conducting the business that is far from profitable. The writer, with many years' experience in a large number of shops, has closely followed the question of economical management. The following will indicate a few of the many weak points to be found, especially in the shops of the middle class, that is, shops that lack the strength to accept a large office-building conduit job, but depend on new house work, stores, a fairly large fish job, etc., for a dividend.

The stock-room boy receives, say, six or eight dollars per week; he runs the errands, sweeps the floor, and does other small duties. He has many spare hours, that can be used to good advantage.

Now suppose a man is sent on a contract job, say a new house—a rush job, figured away down low—and minutes mean money. He must stop and equip two or three pounds of nails with leather-heads; the stock-room boy could thread up 10,000 nails in a few days at odd times; and so much is gained.

Some will say, why not have the helper on the job do the threading, and that question has two answers. First, some contractors will not send a helper on the job on contract work until actually forced to do so by conditions. Second, even though the helper was on the job, he is paid more per hour than the stock-room boy. So it remains a fact that one of the time losses is due to this lack of foresight on the part of the office.

The next point is the poor condition of regular stock tools sent to the job, such as boring-machines that have bent sprockets, poor chains, and bit-chucks that are so badly out of order that the bit will not remain fixed. And then follows the star-drills of large size that have one or two cutting points broken; also large brick chisels that are in frightful condition; to say nothing of pipe dies that are worn out, and therefore time consumers.

The next matter is the evil of bidding so low on a job that the shop is sure of getting the contract, in the hope that future business from the same builder will be the result; and an evil it is, too, for it means poor work by the man on the job. He is driven to the limit, and must of necessity slight the work in more ways than one, in order to make time; and when the owner takes possession of the house and fixtures become loose, he can find the cause behind the canopy, where but one screw is holding the outlet plate to the strapping.

The author was recently sent on a job of the sort cited above—a new house, 94 lights, 20 receptacles, 57 switches, among them three sets of 3-ways and 4-ways, garage, speaking tubes, and an elaborate bell system—all of this in ten days, and two days without a helper. I ask any man in the wiring business, is everything perfectly secure and solid in this house? I might add that the garage was reached for a feed for the lights only after drilling an eighteen-inch concrete wall, and the front-door push through a ten-inch sandstone pillar.

Of course it is to be borne in mind that competition is now very keen in this branch of endeavor, and each man is intent on beating out the other fellow, but even at that there should be better regulation, and how that is to be secured is indeed a modern problem, hard of solution.

How many times does a man go on a construction job and find that there is no ladder and none to be borrowed?—more time to either wait for a wagon to bring one or construct one with pieces of two-by-three timber.

Once again on the question of saving, I would say that it is to my mind poor policy to send one man on a fish job in a house with high-grade paper on the walls. I saw one nice long strip of handsome paper torn, through a man trying to make a fish for a switch. It was a BX job and he could hardly be expected to be on the top of an eight-foot ladder and down to the switch level at the same time; as a consequence the BX caught at the switch outlet and the paper suffered—also the contractor, for he was obliged to make good the damage. He figured desperately low for the job and thought to save money by cutting out the helper's time; the result shows the gain.

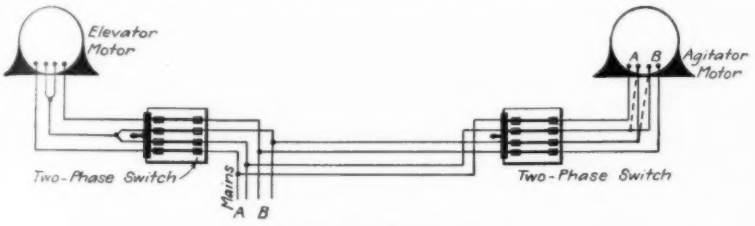
In conclusion I would state that there are many ways in which the contractors may increase the efficiency of their establishments and it does not require the services of an efficiency engineer to point out the path necessary to be followed to bring the shop up to a high standard of success.

Wilson-Maltman Electric Company, of Baltimore, Md., has just finished the installation of a complete power plant and switchboard, together with all other electrical equipment in the new building of the Baltimore Polytechnic Institute. This company is also putting in the wiring and fixtures in the Maryland Agricultural College dormitories and installing the electrical equipment in the Eastern Shore Hospital, at Cambridge, Md. The company has recently taken up the manufacture of switches, switchboards, etc.

Trouble From Interchanged Motor Connections.

There was recently an interesting case of motor trouble arising from the combination of a three-wire and four-wire method on a two-phase system. There were two separate motors in this installation; one driving an elevator and one an agitator. The elevator motor had been installed several years ago and was operating on a three-wire connection from the switch, as shown in the figure. The agitator motor was recently installed and was operated with a four-wire connection, these wires running directly to the two-phase supply line. It was found that the agitator motor would frequently fail to operate but if the switch were left closed it would sometimes start up without further attention.

In investigating the case on one occasion when the motor would not operate, I noticed that the elevator switch had been left open and when this was closed the motor started up, but would stop again when the elevator switch was opened. The trouble was found to be due to an interchange of two wires on the agitator motor, one belonging to each phase. When the elevator switch was closed these two wires were equivalent to a common wire, but when the elevator switch was opened it resulted in a cross connection between the two phases. The trouble was remedied by changing the connections of these two wires. The dotted lines in the figure indicate the proper connections.



Connections to Motors.

H. L. Reagan.

Discussion of Guaranteed Wiring.

The discussion of guaranteed wiring continues among English contractors. At a meeting held at Hull, last month, the Electrical Contractors Association decided that an indemnity should include the following features:

(1) The guarantee is to apply only to dwelling houses, stores, offices and similar premises.

(2) The liability of the association to any one client shall not exceed $250.

(3) Workmanship and material shall conform to the wiring rules of the Institution of Electrical Engineers, but the Association is not to be liable where a lower standard is called for by the contract.

(4) Claims are to be made within six months of the completion of the work.

(5) Claims are to be investigated by a competent engineer, and the Association is to rectify any defects.

(6) The Association is not to be liable for indirect or consequential damage.

(7) The report of the engineer appointed by the Association is to be final and subject to arbitration only as follows. In the event of dispute the matter is to be referred to the Council of the Institution of Electrical Engineers, the said council having power to appoint an engineer to investigate the points in dispute. A report signed by the secretary of the Institution of Electrical Engineers is to be considered as final by all parties.

Warning Against Plating Agent.

We have been apprised by R. M. Douthat, an electrical contractor of Morgantown, W. Va., that electrical dealers should be on their guard against swindling by a self-styled agent of a "film-plating solution." Mr. Douthat has communicated with R. Wallace & Sons Manufacturing Company, whose name is given as reference, and found that this company has no knowledge of the salesman nor the company he claims to represent. The method of operation is described as follows.

The solicitor goes into an electrical dealer's place of business and introduces himself under a name which is probably fictitious, as the representative of the Associated Plating Supply Company, of Chicago and New York, capitalized at $4,000,000, which company is said to control the entire supply of plating materials in this country. He gives as reference R. Wallace & Sons Manufacturing Company, silversmiths, of Wallingford, Conn., and has printed contract forms bearing the name of Wallace & Sons. If the victim agrees to purchase plating film to the amount of $135 he will execute a Wallace contract; but if the dealer confines his order to a small amount, the agent pens a contract in almost illegible writing on a blank piece of paper, which he signs as salesman and representative, Associated Plating & Supply. The agent agrees to permit the return of the plating material if the customer is not satisfied. He offers to assign as much territory as the dealer cares to operate in.

The agent is described as a medium-sized man of about 35 years, with a smooth face and a fancy knitted tie of several colors. He claims Chicago as a residence and is on his way there to pay off a mortgage on his property which came due November 1.

Organization.[1]

Organization is the watchword of our day. The master minds are placing themselves in the midst of the force that is moving world onward, but they are supplementing themselves with the assistance of other men and minds; in short, they are organizers, combinations, associations, federations, etc., which are the magic names for our financial, political and industrial world.

In order to consider this proposition intelligently, it is necessary that we be frank with ourselves; so let us come out in the open and wave aside every suggestion that is based upon superstition. We are not here to deal with the subject theoretically by promising ourselves impossible results. Let us submit the proposition to the radium of analysis and discover, if possible, the benefits to be derived through practical and intelligent co-operation.

First, let us ask. What is Organization? It is the assembling and mutualizing of interests by association and co-operation; it is, in fact, a concentration of individual efforts in the direction of a general distribution of responsibility to the end of practical benefits.

Accepting this as the definition, we must admit that its efficiency depends largely upon the recognition of our individual responsibilities as members to prescribed rules and laws, a loyalty to certain objects and purposes and appreciation of facts that a distribution of benefits cannot be acquired through any law based upon the selfish purposes of advancing the interests of any individual.

An organization of the various interests of the electrical industry can be successful only so far as it recognizes the equal rights and privileges of every department of the great industry which it represents.

An organization that affects to mutualize individual interest by association must depend upon its benefits, not upon the interests represented or the individual representing these interests. This individual responsibility of membership is the great and important factor in its life and prosperity.

From the beginning of time organization has been a condition of man's ex-

1 John R. Galloway in *The National Electrical Contractor.*

istence. It has come down to us in this twentieth century crowned by the laurels of its successful past. It behooves us in this day and generation to accept its record as a gift to be continued on and on into the histories yet to come. It comes to us as a heritage of our fathers, a legacy so flexible in its character as to admit of being molded even as the potter molds his clay to the demand of his deft and artistic touch. So we, accepting it as the result of successful experiment, mold it by our constituted laws and rules to meet the demands of our varied interests.

This subject is so broad and comprehensive that, to do it full justice, we would require vastly more time and thought than we can bring to its consideration today; consequently I shall be brief and touch upon such points as I feel will apply to our condition, leaving my thoughts with you for your consideration, feeling that you will separate the chaff from the wheat and trusting that you may find in them some seed.

An ancient philosopher and sage is credited with saying that the great trouble with social, economic and business conditions in his time lay in the fact that there were round holes and square holes; that the round men got into square holes and square men into the round holes. It was to remedy this evil that the National Electrical Contractors' Association was formed. Through its influence you pool the intelligence, the sentiment, the patriotism, the ideals and the energy of associated interests. You place the round men in the round holes and the square men in the square holes, and you have established an effective organization upon a foundation that must result in benefits by practical and intelligent co-operation.

It requires power to do things that are worth doing. In unity there is power. The very texture of modern civilization is the story of associating forces for a common end. The old days of the individualists are gone. The socializing of force is the characteristic feature of business today. Not only the large enterprises, but the small businesses, depend for their success upon organization more today than ever before in the annals of time. Of prehistoric man we knew but little other than that furnished by scientists, but from the very dawn of history we perceive the value of organization in promoting civilization by promoting accumulation and achievements of the thrifty and industrious.

Organization is co-existent with progress. Without it no project of any magnitude can succeed. Trade organizations have for their primary idea the betterment of man's condition materially, but they do not altogether divorce him from advancement in things connected with his intellectual evolution. Intelligent organization must have for its inspiration the establishment of that brotherhood of man which yearns for higher ideals and the recognition of man's dependence one upon the other, insuring his mutual protection and security. The world's history from the creation down to the present day is proof that organization is the basis of success, not alone for the individual, the home, the state, but in fact, for every department of our governmental and business existence. It has long since been accepted as a recognized fact that it does not conduce to good order to allow each man his own mind.

Unity of action must exist. Our national government, of which we are so justly proud, is a lesson in organization. The individual can do but little; the state is mighty, but the confederation of the states is all-powerful. And so in local organization the assembling and mutualizing of the individual interests by association and co-operation, the concentration of individual effort, the distribution of responsibility and the furnishing of the unit of the organization for the combined information of all, must be productive of practical benefits.

The church with its organization is a builder of character. The legal profession and statesmen are builders of governments, and all other varied interests through our broad land have their organization. And you hold the most prominent of them all. You furnish that which all must have, the light and power, which could not be eliminated for a single day. On every hand is seen evidence of your intelligence and skill, proclaiming that yours is a profession strongly identified with the development of the world. Every building, public or private, of every character shows evidence of your handiwork. The interior and the exterior adornments and decorations in lighting, the many appliances in use by the medical profession to relieve suffering, the very many appliances to bring joy and comfort to the homes, every device for the protection of life and limb on land and sea, are all yours.

There is no place in the councils of a live business organization for a narrow-minded man. The narrow-minded man, who becomes a factor in an organization, will soon show evidence of expansion. The allwise man will soon realize his limitation, and all members, through a more just appreciation of their association, will feel the momentum of independent ways and means in proof that organization is the basis of individual success.

In the last analysis we must agree that all members and interests are mutual in at least one thing, namely, the success of the organization itself; so then the manufacturer, the jobber, the retailer, and the contractor are conserved, inasmuch as the success of one is dependent upon the other. They are simply spokes in the wheels of progress. Effective organization, which means the pooling of the intelligence, the patriotism, the sentiment, the ideals, the energy and influence of progressive people whose interests and environments are mutual, is the only means by which success may be obtained. The more progressive and broad gauged our organization is, the greater will be its usefulness. Organization itself needs to be improved as we recognize the futility of some old method and the necessity of adopting new.

The best rule to produce co-operation is the golden rule. Life reciprocates among those who do unto others as they would that others do unto them. The native vigor of downright honesty creates an attraction that is hard to resist. When a man succeeds in convincing others that he is possessed of truth and principle and has an interest in his fellows to a common end, the element of confidence is created and the spirit of co-operation is thereby established.

One more illustration. Organization is not a suggestion. It is a reality. We are surrounded by its successes developed by concentrated effort. Take, for example, the Federation of Labor. It lacks that loyality of a large percentage of its members who, by circumstances and under protests, are continuing their connections, being held together by the interested effort of successful workers who have built up an organization that in its labor knows no rest. It is always on the alert and in times of peace is prepared for war. In a little over twenty years this federation of labor has acquired a membership of something over sixteen hundred thousand. This is an object lesson. In the great field of organization the question of direct or indirect benefit does not appeal to them. It is simply a concentration of effort.

We will never have an organization that will pilot feet of idlers, soaked in discontent, along the road to Easy street. We'll never have an organization that will beat down and smash the busy, cheerful, hustling man who works and saves his cash. The man who looks to any organization for bed and board will reach the poorhouse when he is done complaining of his woes. No organizations will strew your path with flowers. So, while your president and other officers are doing their best we also should do ours.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Signaling on Trolley Feeders.

On a suburban trolley line a storage battery was installed eight miles from the power house. There were two 500,000-circular-mil wires feeding the trolley at this point, but there was no telephone line to notify the dynamo tender of the condition of the battery.

I installed a hydrometer in cell No. 1 of the battery, with platinum contacts, as shown in the figure. These contacts were connected respectively to a red and a green lamp on the outside of the battery house where they could be seen by conductors on passing cars. If the battery was fully charged the hydrometer would rise and light a blue lamp. Upon noticing this a conductor would stop and open switch A for a few seconds and close it again. This would cut out current over feeder A, while current through feeder B would cause the armature of the relay R to be attracted toward A_1, thus lighting the blue lamp in the power house. The relay armature was magnetized so that it would hold the contact on the blue lamp until released by the dynamo tender, who would know that the battery was fully charged and would consequently lower the voltage on the feeders at the power house.

If the battery was fully discharged, the hydrometer would lower sufficiently to make a contact, lighting the red lamp. The next conductor would pull switch B for an instant, thus causing the red lamp in the power house to be lighted, indicating to the attendant that the voltage was to be raised.

Edward H. Herbst.

Pulling Wire Into Conduit.

In pulling wire into conduit lately I came across a particularly obstinate run about 50 feet in length containing nearly 360 degrees of bends. At one of these bends the steel snake refused to go further. I tried various schemes which have been suggested without success, and then hit upon the following. After pushing the snake into the pipe as far as possible from one end I took a length of iron wire and bent a double hook in the end of it. This was pushed in from the other end of the conduit far enough to meet the snake, when I found that it would engage the hook at the end of the snake and stand enough strain to pull the snake through.

This means will be found advantageous on long runs buried in concrete.

John Shortt.

Splicing Stranded Cable.

To splice stranded cable where there is no mechanical strain I use the following plan. Take a piece of fixture casing about six inches long and drill several holes in it. Insert the two ends of the cable to be spliced until they meet at the middle of the casing. Tape the two ends of the casing to the cable insulation to prevent the solder from escaping. Then apply a blow-torch flame to the center of the casing. This will heat both elements sufficiently to melt wire solder into the holes above mentioned.

K. S. Wonderly.

Lighting Lamp From a Distance.

I was called upon to arrange for operating a bracket lamp in a hall from a switch at the end of the hall and conditions only permitted running two wires to this switch. There was a key socket on the bracket and this key might sometimes be turned off, which would make any switch in series ineffective. In order to connect the switch in parallel with the key upon the socket, I ran an extra wire in the bracket arm to the socket and soldered it on one of the lamp terminals beyond the key switch. This wire was run to one terminal of the switch at the other end of the hall, while the second terminal was tapped on in the canopy to the wire going to the other side of the break in the socket. Needless to say it was a single-pole socket.

H. Piccard.

Handy Way of Carrying Soldering Paste.

A kink in the issue of October 25 dealt with an unusual way of applying soldering paste. I have tried the method given and do not find it to work very well. After the torch has been burned for some time the paste will melt and flow through the slot. Furthermore, when applying the paste to the joint, the flame of the torch will be directed upon some point where it may do damage, as by blackening the ceiling or burning the insulation. Then, too, a great deal of time is wasted by refilling and emptying the paste holder before and after every job.

On large soldering jobs I use the device shown in the figure. A 2.25-inch shade holder is fastened to the strip of metal which joins the handle of the torch to the gasoline tank. After the torch has been heated a can of paste is placed in the shade holder and held in position by tightening the shade-holder screws. This enables me to carry the torch and paste in one hand. This method can also be applied to a "mouth-blow" torch by fastening the can of paste to the body of the torch by a strip of tape.

Alexander Fischer.

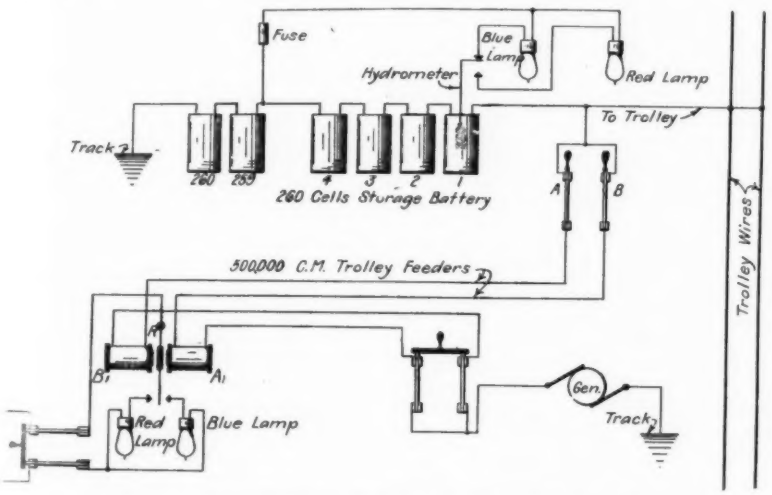


Fig. 1.—Connections for Signaling Over Trolley Feeders.

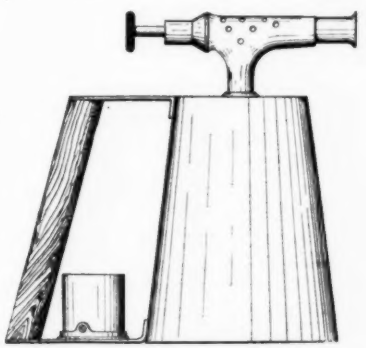


Fig. 2.—Method of Carrying Paste.

Public Service Commissions

CALIFORNIA.

The Railroad Commission has rendered a decision granting authority to the California Telephone and Light Company to issue $100,000 of bonds and $50,000 of stock, the proceeds of which will be devoted to new construction and equipment, and refunding indebtedness.

MASSACHUSETTS.

On a petition of the Edison Electric Illuminating Company of Boston for approval of an issue of additional capital stock of the par value of $2,275,600, the Massachusetts Gas and Electric Light Commission rendered, on December 2, a decision favorable to such an issue, and names $215 per share as the price at which the stock shall be issued, the same as was determined by the company's directors. The proceeds of 13,348 shares are to be applied to the payment of notes outstanding September 30, 1913, and of 9,408 shares to the payment of obligations incurred for the additions to plant made after that date.

NEW YORK.

The Public Service Commission for the First District has discontinued its investigation into certain practices of the New York Edison Company relative to its arrangements with parties having private electrical plants. Commissioner Milo R. Maltbie criticizes the company for not having maintained an adequate inspection service, and for not strictly enforcing the terms of its contracts. The case in point was that of a contract with the St. Nicholas-Hygeia Ice Company, afterwards the St. Nicholas Ice Rink, Incorporated, which had an isolated plant, at first for breakdown service only, but afterwards superseded by a general-rate contract. It was shown by the evidence that during the time of the first contract a connection was established between the plant in the rink building in West Sixty-sixth Street and Healy's restaurant, at Sixty-fifth Street and Columbus Avenue, but within the bounds of the same city block, and current was supplied from the rink for a time, although it was said that no Edison current was transmitted in that way. During the hours when the rink plant was inspected, it was shut down, but no investigation was ever made as to the wiring, even when the second contract was made. Commissioner Maltbie holds that the company was negligent in not having adequate inspections made, and in not strictly enforcing the terms of the contract, which of course was, he declares, in effect preferential and discriminatory. He says that the company has not followed the principles laid down by the Commission in the case of Frankel Brothers, in which it was held that the company was justified in refusing to give breakdown service, because the complainants were supplying current from their own plant to the Phipps model tenements, and were to that extent a competitor. The commissioner also quotes from the testimony of John W. Lieb, Jr., vice-president and general manager of the Edison company, in which he maintained that it was necessary for the company to take cognizance of the facts in a situation in which a possible customer might not only make his own electricity, but even supply his next-door neighbor. Mr. Maltbie continues:

"It would seem from this testimony that the Edison Company has not yet determined that it will enforce all of its contracts with customers, and conform to its published schedule, with reference to the combination of current consumption in separate buildings, in certain cases in which it would be practicable for the customer to make use of a private plant. In other words, an illegal concession or discrimination is being made in order to prevent the possible loss of customers through the installation or use of private plants. It is hardly necessary to say that the fear of such competition or loss of customers cannot be accepted as an excuse for failure to observe the company's published schedule of rates. No company can be excused so long as it knowingly departs from its published rates and regulations, and every company is under a strict obligation to use all reasonable means to prevent any violation of its regulations."

Mr. Maltbie adds that there is no occasion for the adoption of an order, because the practice shown to have existed is clearly in violation of law, for which a statutory penalty is provided, to be secured in the courts. He concludes as follows:

"It should be understood that the Commission will insist on a strict and vigilant enforcement of service contracts and published rate schedules, and on the adoption, by the various companies under its jurisdiction, of all means and devices reasonably necessary in order to determine whether any violation by customers is taking place."

OHIO.

The Greenville Electric Light and Power Company has been authorized by the Public Utilities Commission to issue common capital stock in the amount of $30,000, to be sold for not less than par, proceeds to be devoted to constructing a transmission line to Union City, and making additions to the boiler plant.

PENNSYLVANIA.

In testimony before the Public Service Commission, Nathan Hayward, chief engineer of the Bell Telephone Company, stated the estimated replacement value of the Bell companies in Pennsylvania was $73,257,108, divided as follows: plants, $54,654,281; other plant assets, $3,216,951; going-concern value, $15,385,876. These figures are as of August 31, 1912, and were embodied in the protest of the Bell Company against the proposed telephone rate schedule. The Commission will resume the hearing, which involves the physical valuation of the properties, on December 17.

The Schuylkill Light, Heat & Power Company is asking the Public Service Commission for consent to engage in business in Ashland, to which the Eastern Pennsylvania Light & Power Company is seriously objecting.

WISCONSIN.

The Wisconsin Railroad Commission has handed down a decision directing the joint use of the tracks of the Milwaukee Northern Railway Company on Wells Street in the City of Milwaukee by the Milwaukee Electric Railway and Light Company and prescribing the conditions under which the joint use shall operate. The decision is somewhat lengthy because of the discussion of differences between the companies as to maintenance, sale and purchase of power, liability for accidents, etc. All of the various contingencies which are likely to arise in the joint use are detailed and provision made for meeting them. The major portion of the decision deals with the question of

compensation, its nature and how determined. The proper amounts to be expended annually for maintenance, renewals and interest are discussed and it is provided that the Milwaukee Electric Railway and Light Company shall pay to the Milwaukee Northern Company such proportionate amount of the annual expenditures for maintenance, taxes, renewals and interest as its ton-miles of operation bears to the total ton-miles operated over the track in joint use. The electric power required to operate all cars over the portion of track in question is to be furnished by the Milwaukee Electric Railway and Light Company as long as conditions at distribution shall warrant, and at such a rate to the Northern Company as will not entail any additional expense to that company by virtue of the joint operation.

In a similar order, the Commission has ordered the Chicago and Milwaukee Electric Railway Company to permit the joint use of a portion of its track by the Milwaukee Electric Railway and Light Company under conditions governed by the same considerations as in the case cited above.

Upon the recommendation of the Commission, the Madison Gas and Electric Company has made a material reduction in its rates for electric lighting in the city of Madison, which reduction went into effect on December 1. The primary rate has been reduced from twelve cents per kilowatt-hour to ten cents; the secondary rate, from eight cents per kilowatt-hour to six cents; the excess rate from four cents to two cents. The primary rate applies to the first 30 hours' use per month of the active connected load; the secondary rate to the next 60 hours' use per month. This is the third material reduction which has been made in the rates of the Madison Gas and Electric Company since April, 1910. The Commission recommended the reduction nearly a year ago but advised that it be not put into effect until a satisfactory understanding had been reached with the city authorities concerning the terms of the pending street-lighting contract.

South Yuba System Started.

The first plant of the South Yuba hydroelectric system, which the Pacific Gas & Electric Company is constructing, has been placed in operation. The system contemplates an ultimate development of nearly 200,000 horsepower, of which the present plant comprises 33,000 horsepower.

The power thus made available will relieve the shortage from which the Pacific Gas & Electric Company has recently been suffering.

Rivers and Harbors Congress.

The National Rivers and Harbors Congress for 1913 was held at Washington, D. C., December 3, 4 and 5, with 2,000 delegates in attendance from all parts of the United States, and the subject of water powers was at once injected into the deliberations of the body by an address by Rome G. Brown, of Minneapolis, Minn., entitled "Legislative Obstacles to the Improvement of Navigable Rivers." Mr. Brown, in discussing this subject said, in part:

The Federal Government has rightly spoken its assertion of navigation control when the Congress prohibited construction of private water-power dams in navigable streams without federal consent. The development of electric science has made commercially feasible in many instances the development by the riparian owner of his water-power rights in navigable streams. In most instances development for navigation alone, whether by the Government or by private enterprises is impossible as a financial problem on account of the prohibitive cost. Development of the water power on the other hand by the private investor is such a hazardous and doubtful undertaking that, especially when there is added the burden of the navigation facilities, to say nothing of further burdens proposed, the present uncertainties make the situation prohibitive. These problems are to be solved only upon the basis of assistance and co-operation of private capital on the one hand and of the Government on the other hand, with concessions sufficiently liberal to attract private investment.

But to the solution of this problem there are and for a long time have been presented obstacles, mostly legislative in their character, which must be overcome before any substantial progress can be made. These legislative obstacles are of two classes: (1) present statutory restrictions, together with the present policy or lack of policy with regard to their enforcement; and (2) the persistent advocacy of further restrictions and burdens upon development by private capital which make private investors halt for fear of returns ultimately insufficient, and for fear of an entire loss of investment.

It is a significant fact, due to these legislative obstacles present and proposed, that for something over six years there has been practically no hydroelectric development upon the navigable streams of this country under any federal consent granted within that time, and this, too, although within the same time the science of economic hydroelectric development has progressed more than in all the years preceding. Millions of capital representing various and competing interests have been and are now ready, upon reasonable and business-like terms and conditions, to develop the natural resources of our highway streams, both for power as a private business investment, and, incidentally, for navigation as a concession to the general public interest, which latter interest for the purposes of navigation is represented by the Federal Government.

This stagnation in navigation improvement, and at the same time of water-power improvement, has been caused by the impossibilities of the existing Federal Dam Act, its uncertainty of tenure, its determinate franchise, arbitrarily revocable, and the uncertain and indefinite provisions for the arbitrary imposition of further financial charges and burdens.

The recent Chandler-Dunbar decision has been claimed by some to be an epoch-making decision, and to turn over to federal control all the rights of the respective states and of private riparian owners in the beds and waters of navigable streams. On the contrary, this decision confirmed the law of control as theretofore established. It confirmed the recognized paramount right of the Federal Government to regulate navigable streams in the interests of navigation. It confirmed the right of the Congress to pass and to enforce the Act of 1909 asserting the necessity of entire control in the interests of navigation of the straits of the Sault Sainte Marie in order adequately to protect the navigation between two great inland seas. That decision was neither an assertion nor authority upon the part of the Federal Government of the unlimited federal control for all purposes of the highway streams of the United States.

The present problems of navigation improvement could be solved only by proper legislation, recognizing the constitutional rights of the Federal Government upon the one hand, and asserting a policy of attracting the investment of private capital upon the other hand. This could be done only by the following provisions defining the establishing of hydroelectric works on navigable streams:

(1) Indeterminate permits subject to revocation on payment to the grantee of all his necessary investment for structures which are a part of or appurtenant to his plant and enterprise; no value to be added for the federal permit, as such; and the assumption of all outstanding *bona fide* contracts made by the grantee.

(2) All permits to be only to a public service corporation and the regulation of its corporate affairs including rates to be left to the proper state authorities.

(3) In order to prevent speculating in holdings, proper provisions compelling the utilization of power facilities within a reasonable time.

(4) No tolls or fees except such as are necessary to cover the cost of service inspection, etc., directly chargeable to the exercise of governmental functions; but the grantee to provide to a reasonable extent, consistent with existing conditions, navigation facilities, including power for their operation.

The American Telephone and Telegraph Company is now operating through its associated and connecting telephone companies in the United States a total of 7,782,000 telephone stations, located in and reaching more than 70,000 places. The extent of this may be realized by comparison with the Government's postoffice stations, which number less than 65,000; railroad stations, which number about 60,000; and telegraph stations, which reach the number of about 25,000.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 175.—Two-Rate Meters.—Has any American central-station company employed two-rate meters for residences and other small customers connected to its miscellaneous lighting circuits? What method is used to change from the low rate to the high rate during the time of peak load and back again? What effect has this had on the peak? Is the time of high rate adjusted during the different seasons to correspond with changes in the station peak? Does the two-rate meter eliminate the need for primary and secondary rates based on maximum demand? What is the relative cost of a 10-ampere, two-rate induction meter compared with a similar standard meter?—V. P. B., Milwaukee, Wis.

No. 182.—Searchlights.—Is a yellow-colored searchlight beam more penetrating on a foggy night than a white beam? What is the greatest distance that a searchlight has been seen on a clear night?—W. M. L., Baltimore, Md.

No. 185.—Loom for Combination Fixture Outlets.—In this city the wiring inspector requires all gas stubs to be loomed in both electric and combination fixtures, instead of using tape as was formerly allowed. How can the loom be secured so that it completely covers the stub and will not work off if the bottom of the canopy does not come in contact with it, as where a deep canopy is used?—R. O., Portland, Ore.

No. 186.—Special Three-Point Switch Control.—A pair of white lamps in a hall is to be controlled by a pair of three-point switches, one at each end of the hall, but instead of turning the lights out a pair of red lamps is to light up when the white lamps are switched off. In other words, when either switch is turned it will merely change the circuit from the white lamps to the red lamps or the reverse, there being no "off" position to the switches. I would like to arrange such a circuit and want to know if it can be done and how?—J. C. M., Del Mar, Cal.

No. 187.—Wiring in Packing House.—I want to install the most approved system of wiring and up-to-date material in a packing house with very damp rooms and cellars. Which is best—iron-pipe conduit, lead-covered cable or flexible-steel conduit? It seems to me lead-covered cable would be best, as water can hardly be kept out of conduits and causes untold trouble. I should like to hear from some readers that have had experience in such work.—J. McQ., Cincinnati, O.

Answers.

No. 181.—Repulsion Motor.—What is meant by a repulsion motor? How does it differ from induction motors? What advantages has it, if any?—T. A. J., Streator, Ill.

Authorities differ as to the extent of the meaning of the term repulsion motor. According to Franklin and Esty ("Dynamos and Motors," page 383) "The repulsion motor consists of a primary or stator member which is identical to the stator of a single-phase induction motor, and a secondary or rotor member which is like an ordinary direct-current armature with commutator and brushes. The primary is supplied with single-phase alternating current, and the secondary member is short-circuited by connecting the brushes directly together." A figure accompanying this statement represents a two-pole repulsion motor, and shows the two brushes short-circuited and set diametrically opposite each other on the commutator and in such a position that the diameter drawn through them makes an angle with the center line through the poles of the primary winding. McAllister, in his book on "Alternating Current Motors," divides them into the three classes, induction, synchronous and commutator motors. The latter class he discusses under the two divisions of series and repulsion motors. From these books we might conclude that any single-phase commutator type of motor which does not have its field and armature connected in series is a repulsion motor, but other authors do not agree to this. Bailey, in his book on the induction motor, limits the repulsion motor to that form of the single-phase commutator motor having but one pair of brushes per pair of poles. All of the machines which McAllister classed as compensated repulsion motors are called compensated induction motors by Bailey. Hobart in his electrical dictionary differentiates the simple repulsion motor from the simple commutator type of induction motor in the same way that Bailey does, but in describing the compensated types of the induction and repulsion motors does not make any clear distinction between them. Of the numerous other authors consulted all are vague on this question. Though all are agreed that the simple repulsion motor is differentiated from the other types of single-phase commutator motors by having but one pair of brushes per pair of poles and these brushes being set at an angle to the center line of the poles, I believe there is no well-defined practice in regard to the use of these terms with respect to the compensated types of motor.

The repulsion motor has the advantage of a good starting torque and it has therefore been used to a considerable extent as a means of starting the single-phase induction motor which is not self-starting in its simple form. For this purpose the machine is usually built as described above but provided with weights which are thrown out by centrifugal force, raising the brushes and at the same time short-circuiting the commutator, thus converting the machine into practically a squirrel-cage type of motor at normal speed. As the repulsion motor has series motor characteristics it has also been used to some extent as a railway motor.—F. E. V., Madison, Wis.

No. 183.—Slotting Commutators.—Has the practice of slotting commutators proven to be as valuable as was predicted several years ago? Is it increasing or decreasing in vogue? What is the best tool to use for this purpose?—F. S., Houston, Texas.

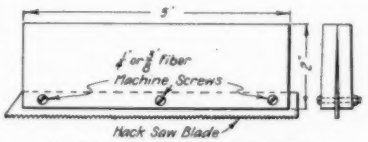
The practice of commutator slotting is increasing. All of the electric railway shops make a practice of slotting when overhauling armatures and make use of various machines that are on the market for such work. These consist of a small saw, power driven, arranged to travel across the commutators and cut the mica as deep as set. Outside repair shops are also slotting more or less and making use of all sorts of schemes to obtain the results. Many use a hack saw blade held in a wooden handle for stiffness.—W. M. P., Seattle, Wash.

This practice has indeed proven valuable and in the design of many machines such as single-phase commutating motors, turbogenerators and many machines of a special nature undercutting is considered a necessity. The practice of undercutting allows a better contact and eliminates burning of the commutator and brushes due to high mica, thereby improving commutation and increasing the life of the commutator and brushes. The only trouble that might arise is the accumulation of dirt in the slots. Ordinarily the centrifugal forces developed in the machine will prevent any trouble from this source. The practice of undercutting of commutators is increasing in popularity both with operating companies and manufacturers. The most satisfactory tool for slotting commutators consists of a thin saw or milling cutter suitably mounted and connected to a source of power. The methods of mounting and driving the cutter vary considerably and must be chosen to be adapted to local conditions. For instance some tools are mounted directly on the bed of an engine lathe

and are either belted or electrically driven, while others consist of a suitable portable guide on which is mounted the cutter, the latter being attached through a flexible shaft to a small electric motor. The saw proper should be about one inch in diameter with 30 to 40 teeth and driven at a speed approximating 2,000 revolutions per minute. The thickness of the saw should be about 0.003 inch less than the width of the slot to be cut. The depth of the slot to be cut should be approximately one thirty-second to three sixty-fourths inch and in any case should not exceed one sixteenth, as deep narrow slots will have a tendency to collect dirt and thereby overcome the advantages gained in undercutting.—C. L. S., Chicago, Ill.

I believe that the practice of slotting commutators has proven to be of great benefit, but think that the success of such depends entirely upon the judgment exercised in selection of machines to be slotted. A machine running below 600 revolutions per minute is seldom slotted. The centrifugal force of the commutator when running at a fairly high speed is relied upon to partly keep the slots clear of carbon, graphite or copper dust. The difference of potential between bars will generally burn out any solid accumulation of dust without doing any harm to the apparatus. On a high-speed machine only a very small difference in the height of mica and copper will cause brushes to chatter. There are a large number of machines put on the market whose mica will continue to "rise" or slip up even after the so-called process of "seasoning." If after tightening the clamping bolts the mica continues to "rise," the only remedy is to slot the commutator, the depth depending upon the grade of brushes used, voltage, speed and operating conditions; keeping the mica just below the copper, about one sixteenth inch, will generally do a lot of good and never any harm on these machines. One of the greatest advantages of slotting commutators is being able to use graphite brushes. Of course, on account of their low contact resistance, graphite brushes can be used on very few high-voltage machines (500 volts and over) without producing sparking, while on nearly all low-voltage apparatus they usually give most excellent results. Graphite brushes have very little abrasive material in their composition, hence they will not wear the mica down rapidly enough to keep it even with the surface of the commutator, for this reason it is general practice to slot the mica to a depth of one thirty-second to one sixteenth inch when graphite brushes are used. The slotting of commutators seems to be increasing with the increasing output of high-speed apparatus. Commutators can be slotted with a machine built for this purpose; there are a number in use, operated either by hand or a small motor, or they can be slotted with a hack saw blade; when the latter is used some device is required to hold the blade or pieces of blade. For small machines a four, five or six-inch knife file can be used to the best advantage.—H. W. P., New York, N. Y.

As far as the first part of this question is concerned I think it has. In my own experience I have found it to be of great value. In most commutators, the mica is somewhat harder than the copper, and if the armature has a speed above about 1,000 revolutions per minute, using a regular grade of brush, the result will be that the brush will cut the copper of the commutator. Now, if a soft grade of brush is used without slotting the commutator, the mica will cut the brushes, thus necessitating frequent brush renewals. But if the commutator is slotted, and a soft brush used, the operation of the machine will invariably be improved unless the trouble is elsewhere. A large industrial plant located near here operates approximately 50



Tool for Slotting Commutators.

electric bridge cranes ranging in capacity from 10 to 120 tons. Formerly the armatures in some of these crane motors had to be changed every two or three weeks. They tried slotting the commutators and using a softer grade of brush and found it worked so well that now they are practicing it on all machines which run over 950 revolutions per minute. This, I think, answers the second part of the question. As to the best tool to use, there are compressed air and electric machines on the market made expressly for this purpose. These machines use a very small circular saw just the thickness of the mica. But if only a small amount of this kind of work is to be done, the tool illustrated in the sketch herewith answers very well. I use a hack saw blade about the thickness of the mica and grind the "set" out of the teeth before using it. —W. R. Smith, Chester, Pa.

No. 184.—Wiring in Concrete Buildings.—Does it cost more to install a conduit wiring system in a reinforced-concrete building than in a building with steel and tile construction? If so, what is the percentage increase in cost?—E. W. M., Cincinnati, O.

The cost of installing conduit in a reinforced-concrete building is usually more than in a building with a steel frame and tile floors and partitions. A good wireman and helper should set about 80 outlet and switch boxes in a day of eight hours providing they are not compelled to waste time in locating the outlets. This would apply to a loft or office building of either construction. In hotels, apartment houses, etc., the number would be less. After the boxes are set and providing there are only a few bracket outlets and the average number of switch outlets, a good wireman and helper should install about 190 feet of one-half-inch conduit, or 175 feet of three-quarter-inch or about 110 feet of one-inch conduit in a day of eight hours, making all bends (except in one-inch conduit where standard ells should be used for 90-degree bends), cutting and threading, in a reinforced-concrete building. In a building of steel and tile the same wireman and helper should install from 200 to 250 feet of one-half-inch conduit, about 200 to 240 feet of three-quarter-inch and about 150 feet of one-inch. Conditions vary considerably in different buildings even of the same class of construction. Sometimes there is a hung ceiling which requires the conduits to be hung from the slabs, then the slabs may be so thin that the designing engineer will not permit the conduit to be laid on the forms and thus be bedded in the concrete and one or more 90-degree bends will have to be made at each outlet. The same conditions will be met in tile construction.—C. T. P., San Francisco, Cal.

The cost of installing conduit in a building of steel and tile construction is greater than that in a reinforced-concrete structure. When installed in concrete, the conduit is usually laid in the cinder fill of the floors before the final pouring of the floors, making the installation a simple matter. If the conduit is to be run open on the ceiling beneath the room containing the apparatus at which the conduit is to terminate, slots or sleeves may be left in the floor through which to bring the conduit up to the apparatus. Very little, if any, drilling or tearing up of the flooring is necessary, therefore. With steel and tile construction, however, conditions are different. In this case the conduit is run in the tile or open on the ceiling beneath, depending on the nature of the installation. In either case it is necessary to break the tile considerably in order to up-end the conduit. The difficulty of drawing the conduit through the tile, especially if the conduit be of the screw-joint type, and the necessity of breaking the tile to a greater or less extent, are the factors causing the greater cost of installation. Here, as in most things, the factor of the "personal equation" of the workman is involved, but the average increase of cost of the latter over the former method of conduit installation will not be far from 30 per cent.—L. D. W., Chicago, Ill.

LETTER TO THE EDITOR.

Board of Trade Units.

To the Editor:

In your issue for November 15, I notice a review of Mr. Patchell's book "Application of Electric Power to Mines and Heavy Industries." I wish to correct an impression which Mr. Wood has evidently received from reading this book, namely, that the term "B. t. u." as used by Mr. Patchell is an abbreviation for British thermal unit. This was also my impression on first reading the book, but some of the values given did not check out as they should in line with what I had observed. I find that Hering in his book "Conversion Tables," states that in England the term "B. t. u." is an abbreviation for Board of Trade unit, which is the same as a kilowatt-hour.

C. M. JESPERSON.

Birmingham, Ala., December 3, 1913.

[Many English authors use the abbreviation " B. Th. U." for British thermal units where there is any likelihood of confusion with Board of Trade units. —EDITOR.]

Big Creek Power Plant Put in Service.

The Big Creek power plant of the Pacific Electric Company, Los Angeles, Cal., has been put in service. This plant when completed will represent an expenditure of about $60,000,000. The power house in the mountains cost alone $1,000,000. The capacity of the Big Creek reservoir is 125,000 acre-feet, and it is expected that the company will be enabled to generate 400,000 horsepower when the work is finally completed. This, however, may take at least eight years. The transmission line consists of aluminum cables, 8,000,000 pounds of aluminum having been used. For the line towers 1,400 tons of steel were required. The company found it necessary to build 225 miles of mountain roads for the transportation of material.

Lake Spalding Dam Completed.

The Lake Spalding dam of the Pacific Gas & Electric Company, in Placer County, Cal., is completed. The dam has a capacity of 20,000,000 gallons of water. The waters controlled by it will be used in the development of electric power six times before they are turned loose for irrigating purposes. The site of the Lake Spalding dam was acquired by the present owners in 1905 and surveys were made the following year. Construction started in July, 1912, and the last concrete was placed at an elevation of 242 feet on November 17, 1913. The ultimate plan is to make it 320 feet high. The dam has already cost $5,000,000.

BOOK REVIEWS.

"The Science of Illumination." By L. Bloch. Translated from the German by W. C. Clinton. London: John Murray. Cloth, 180 pages (5¼x8½ inches), 47 illustrations, 32 tables. Supplied by the Electrical Review Publishing Company for $2.50.

In this book there will be found much to interest the lighting specialist in the estimation, calculation and measurement of illumination. Dr. Bloch has drawn largely from his own extensive practical experience in illumination and has correlated theoretical computations and approximate estimations with the measurements in actual practice. This combination of data is valuable to the lighting specialist.

The first part of the book is devoted to the explanation of fundamental units and principles and to the determination of mean spherical and mean hemispherical candlepower. There is nothing strictly new in these chapters and some subjects are treated rather unsatisfactorily owing to unnecessary brevity. The following chapters on estimation and calculation of illumination are full of useful information as they contain many data which are original and which though based upon theoretical and approximation formulas are closely allied to actual cases encountered in practice. A chapter on the measurement of illumination contains brief descriptions of a few portable photometers and shows results obtained in a few cases in the lighting of streets and large areas. Tables of comparative results obtained with various kinds of light sources are presented. An especially interesting chapter on indirect lighting is found. Data regarding reflecting power of surfaces are given and by using these data the author devises methods of approximately predetermining illumination values in indirect systems. An appendix containing numerous tables and other data is also present.

The practice of illumination is in such an embryonic state that no treatise can as yet be much more than an expression of personal experience, but experience as extensive as that of Dr. Bloch will always prove to be interesting and helpful.

M. LUCKIESH.

"Light, Radiation and Illumination." Translated from German of Paul Högner by Justus Eck. London: Electrician Printing and Publishing Company. Cloth, 88 pages (5¼x8½ inches), 58 illustrations and 35 tables. Supplied by the Electrical Review Publishing Company for $2.50.

The title of this book is somewhat misleading, for it suggests a broader scope than the text really covers. However, it is gratifying to note that the author has not attempted to treat a subject as extensive as implied by the title within the confines of less than 100 pages. The book is a mathematical treatise of light flux from theoretical and actual light sources (primary and secondary) with the object of determining the final distribution of flux-density or illumination on various planes. Being confined almost entirely to the calculation of illumination, the volume will be welcomed by illuminating engineers because it treats this difficult phase fully and simply. Illumination problems are so varied because of different conditions arising that it is difficult to predetermine the illumination without performing elaborate calculations. The author has treated a great many cases as simply as possible and has so chosen them that conditions found in actual practice are approximated. Predetermined illumination values are however valueless without experience and data which indicate the amount of light required for various activities. Even experienced lighting experts find some difficulty in agreeing upon the limiting value of illumination for various kinds of work. The interpretation of illumination values is also rendered complex, because these two chief means of perception, the ability to see fine detail and the ability to distinguish differences in surface brightness, generally follow logarithmic laws. For instance, in street illumination the ability to distinguish objects under the minimum and maximum illumination as actually found is not measured by the numerical values of those quantities. This fact, however, does not decrease the need for predetermining illumination on various planes by actual calculation. It does, however, illustrate the need for data pertaining to the value of various degrees of illumination for different kinds of work and for different states of light—adaptation of the eye. Little investigation along this line has been done. When more complete information of this kind is available illumination calculations will be invaluable. Without this knowledge actual trial installations must now be installed, thus decreasing the necessity for accurately predetermining illumination by calculation. However, the illuminating engineer will find great assistance in the method of computation found in this book.

M. LUCKIESH.

"Electric Central Station Distribution Systems." By Harry Barnes Gear and Paul Francis Williams. New York: D. Van Nostrand Company. Cloth, 347 pages (5½x8 inches), illustrated. Supplied by the Electrical Review Publishing Company for $3.00.

Quite a few books dealing with power-plant design and with high-tension transmission have been written. There are some books available dealing with low-tension networks, also random pa-

pers in the proceedings of engineering societies and of different electrical associations dealing with various parts of the distribution equipment. But until the present book appeared there was no comprehensive treatment of the modern distribution systems of electrical supply companies. This book by Messrs. Gear and Williams therefore fills a void in the literature dealing with the engineering aspects of the central-station industry.

A general discussion of the different systems of distribution and of the various classes of substations is taken up in the first part of the book, and in this is included a description of various methods for providing voltage regulation. Several chapters then follow on distributing transformers, the design and calculation of secondary distributing networks, and special schemes of transformation. Protective devices including fuses, circuit-breakers and lightning arresters are then discussed. A large part of the book deals with overhead line construction and the equipment therefor is taken up in special sections dealing with poles, insulators, line wire, guys and other accessories. The erection of overhead lines is described in some detail. A similar treatment is followed regarding underground construction, particular reference being made to the various types of conduits, manholes, underground cables, etc. A unique chapter is devoted to distribution economics, under this head being considered the economic sizes of conductors, minimum annual cost and fixed charges, the calculation of losses, and a full discussion of diversity-factor, a subject to which Mr. Gear has given much study. Two chapters on the properties of conductors and the characteristics and calculation of alternating-current circuits are placed at the end of the book.

A clear, simple style is used throughout the various chapters. The mathematics used is not beyond the scope of the ordinary reader, since nothing higher than algebraic forms are used. The general arrangement and logical development of the entire subject makes the book very easy to read and gives even a layman a good grasp of the matter. A unique feature in the book is the historical introduction to the main branches of the subject, which gives good insight to the evolution of the practice that is now generally followed by the most up-to-date central-station systems. The typography and nearly all of the illustrations are good.

The importance of applying the best engineering skill and judgment in the design and construction of the distribution network of a central-station system is gradually becoming appreciated. Much of the work done in this line has been too haphazard and of such flimsy character as to require frequent rebuilding. This has been largely because of the lack of references dealing with these particular problems in central-station literature. The authors of this book, who are engineers connected with one of the largest central-station systems in the world, deserve credit for taking the time to put down in such an excellent manner a good guide to distribution engineering.

"The Electric Vehicle Hand-Book." By H. C. Cushing, Jr., and Frank W. Smith. New York: H. C. Cushing, Jr. Flexible leatheroid, 356 pages (4x6½ inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.00.

The recent development of the electric vehicle and the rapidly increasing use of it has made a field for a book of this kind which supplies a great deal of information which will be desired by the owner or operator of such a vehicle. The authors are familiar with the field which they have attempted to cover and have had in addition the assistance of David F. Tobias. The introductory chapter is by William P. Kennedy. Naturally about half the volume is taken up with a consideration of storage batteries and charging, the description of the various makes of battery and the proper care to be taken of them being gone into in detail. Other chapters deal with measuring instruments; wheels, rims and tires; motors; controllers; and the chassis. Finally there is given a list of associations and periodical publications identified with this field, which will show the vehicle owner where to get current information upon this subject. There are also comparative cost data taken from the research work carried out at the Massachusetts Institute of Technology. The volume should be especially useful to those who are not already familiar with the proper care and methods of operation of storage batteries, but it contains also information which will be of value and interest to every vehicle user.

"Illinois Public Utility Commission Law and Municipal Ownership Law." By William J. Norton. Chicago: William J. Norton. Flexible cloth, 200 pages (8x10¾ inches). Supplied by the Electrical Review Publishing Company for $2.00.

As pointed out in the preface of this volume, anyone who has had occasion to work over the utility laws of the various states will appreciate a printed, carefully indexed and classified working copy of such laws. This volume attempts to supply this need for the state of Illinois. The public utility commission law and the municipal ownership law are each given in full, with every other page left blank, so that there is ample room for copious notes. Each line of the law is numbered, permitting exact references, and foot notes are given to facilitate comparisons with the laws of other states. The foot notes also contain comments upon the law and references to leading court and commission decisions involving the same subject. Preceding the acts themselves there is an index-digest which gives a synopsis of the subject matter of the laws arranged in logical order, which will facilitate references to any specific provision. The volume will be of interest not only to utility managers but to attorneys and other students of the law who wish to have it in convenient form for ready reference.

"Diagram Giving Stresses in Beams." By H. R. Thayer. New York: D. Van Nostrand Company. Price, 20 cents.

This is not a book but a diagram in one sheet, by means of which it is possible to (1) design a beam for given loads and stresses; (2) design a beam for given moments and stresses; (3) determine the modulus of section required for given loads and unit stresses; (4) determine stresses caused by a given load; (5) determine stress caused by a given moment. The diagram is 7.5 by 11.5 inches and should be found useful to civil engineers.

New Telephone Rates Between France and Great Britain.

On November 1 a reduced scale of charges was introduced for telephone calls between France and the United Kingdom. Each country has been divided into three zones; in the first British zone are included the southern and south Midland counties, in the second British zone the rest of England and Wales, and in the third British zone Scotland and Ireland.

The majority of the towns in France admitted to the Anglo-French telephone service are situated in the first French zone; the principal exceptions are Belfort, Cherbourg, Dijon, Epinal, Le Mans, Limoges, Lyon, Nancy, Nantes, St. Etienne, and Tours, which are included in the second French zone, and Bordeaux and Marseille, which are situated in the third French zone.

A three-minute talk during the day costs $1 between the first zones in each country, the charges rising on a scale to $3 between the third zones in each country. Night calls cost only three-fifths of the day rates, with further reductions for subscription calls at fixed times every night.

The Cost of Electric Service.

Some interesting figures on the various elements entering into the cost of central-station service were given by H. B. Gear in a paper presented before the Commonwealth Edison Company Section of the National Electric Light Association at its meeting on October 14, and published in *The Edison Round Table.*

The relative proportions of the factors which make up the cost of serving the average user of electricity in Chicago are illustrated in Fig. 1. It will be seen that the average for all customers is 30 per cent for production expense; 14 per cent for substation; 25 per cent for transmission and distribution; 12 per cent for metering, billing and collecting; and 19 per cent for general expense, which includes sales, executive supervision, municipal compensation, etc. These percentages include both investment and operating expense.

This chart also shows an analysis for the average user on the direct-current and alternating-current systems. It is interesting to note that the relative cost of the scattered distribution of the alternating-current system is approximately the same as that of the much more dense direct-current network. The very large proportion of meter cost in the alternating-current system is due to the fact that the larger number of small customers are supplied on this system. This proportion of the cost is proportional to the number of customers.

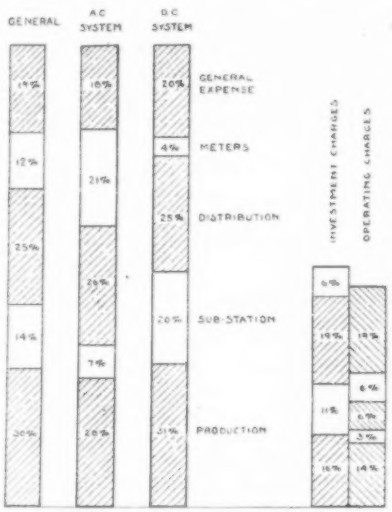


Fig. 1.—Components of Cost of Serving Average User.

At the right of Fig. 1 is shown an analysis of the average cost as between investment and operating charges—the word "operating" being used in its broadest sense. It will be seen that out of 30 per cent of production charges, 16 per cent is due to investment and 14 per cent is due to operation; and in distribution only 6 per cent out of 25 per cent is due to operation. The metering, billing and collecting is practically half investment and half operation. There are no investment charges against general expense items. Thus the total investment charges aggregate 52 per cent and the total operating charges 48 per cent. This distribution of investment and operating charges applies, however, to the average user whose annual load-factor is about 32 per cent, or whose average daily use of maximum demand is 7.5 hours. For the user whose load-factor is less than 32 per cent the investment charges are a higher proportion and the operating charges lower. For instance, if the fixed charges which are due to the demand of a certain customer are $20 a year, the cost due to investment is ten cents per kilowatt-hour if that customer uses 200 kilowatt-hours a year; five cents per kilowatt-hour if he uses 400 kilowatt-hours a year; or two cents per kilowatt-hour if he uses 1,000 kilowatt-hours a year. The operating charges also have some items which are in the nature of fixed charges and are not proportional to the kilowatt-hours used. The decrease in the operating cost, therefore, follows a more complex law, as this does not decrease as rapidly for the increased hours of use as the fixed charges. These relations are illustrated in Fig. 2, which shows the relative distribution of the principal items of cost per kilowatt-hour for a two-hour user; for the average user of 7.5 hours; for a twelve-hour user, and a twenty-hour user. It will be seen that the cost of serving the two-hour user is about three times the cost of serving the average user; while the cost of serving the twenty-hour user is about 40 per cent of that of the average user.

The distribution system constitutes a large part of the entire plant investment. It is evident that the proportion of cost due to the distribution system varies widely because of differences in the location and character of the various classes of users. The cost of reaching users in the outlying parts of the city is necessarily greater than the cost of serving those who are in the more densely settled districts. This difference in level, however, is not at all proportional to the ratio of distances. It does not cost twice as much to give service to users supplied through ten miles of transmission and distribution lines as it does to serve those supplied through two miles of lines. This is due to the fact that the cost of a transmission line ten miles long adds only ten per cent to the total

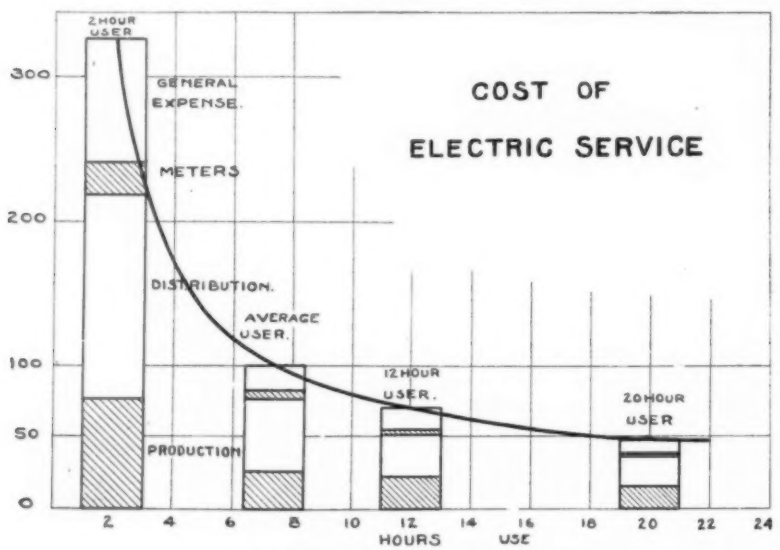


Fig. 2.—Relative Cost of Electric Service.

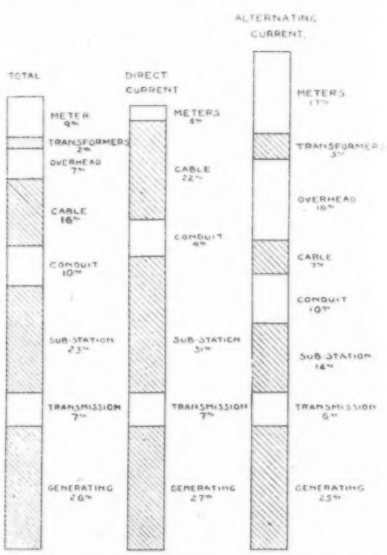


Fig. 3.—Total Investment per Kilowatt.

cost of the distribution system serving the locality at the remote point. The cost of the distributing system per kilowatt is affected much more by load density than by distance. When a network of mains is first established its cost is a maximum. Each additional kilowatt added on existing lines operates to reduce the average amount invested, since the only reinforcement necessary to take care of the added load is in the feeder system. The cost of additional feeders per kilowatt is only ten per cent of the investment in distributing mains, so that the load in a given area can be doubled at small additional investment for distributing systems.

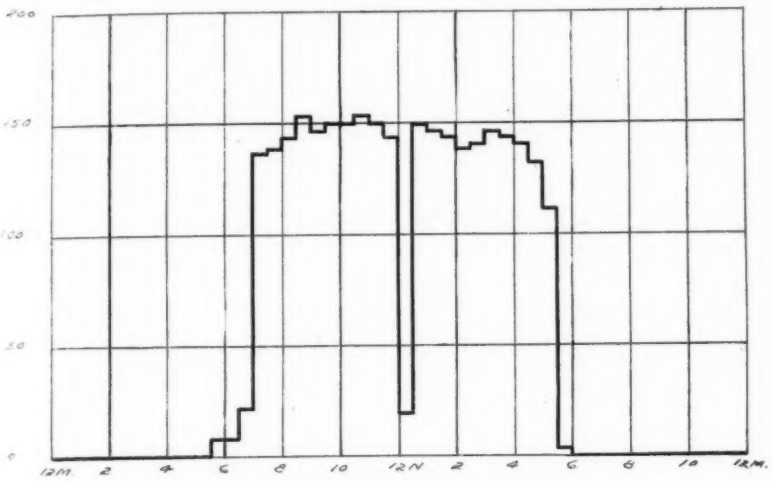


Fig. 4.—Load Curve of a Large User.

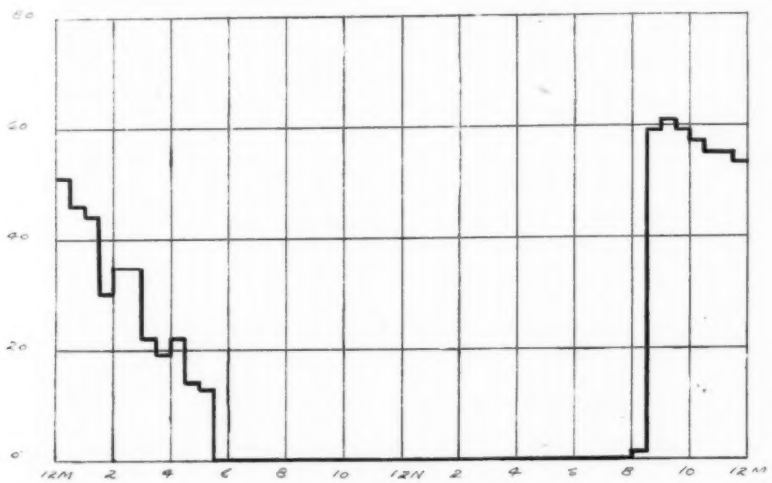


Fig. 5.—Typical Load Curve for Battery Charging.

In Fig. 3 is shown the way in which the plant investment is distributed for the average user, with an analysis of the average user of the alternating-current and direct-current systems. It is interesting to note that when meters are excluded the cost of distributing system for the direct-current user who is supplied by very expensive network is less per kilowatt of demand than the investment required to carry the alternating-current customer. The substation investment for direct-current customers, however, is a little more than twice as great as that required for the alternating-current customer, so that the total for the direct-current customer is somewhat greater than for the alternating-current customer. The large item for meters for the alternating-current customer is due, as explained above, to the fact that most of the small customers are on the alternating-current system. It is almost startling to note that there is as much money invested in meters for alternating-current customers, as there is for the entire overhead distributing system. It is also worthy of note that there is about as much money invested in underground conduit and cable in the overhead territory as there is for overhead lines.

We have dealt thus far with the average user. There are various classes of consumers, however, whose use of electricity is materially different from that of the average user; and it may be of interest to see what variations may be found in the cost of serving some of these typical classes.

Among the small users the apartment and residence consumer and the small store are the most numerous. From the study of diversity-factors and maximum demands from various parts of the alternating-current system, it is possible to determine what proportion of a small user's maximum demand, as indicated at his premises, requires transformer, distribution, substation and generating-station investment.

The following figures, based upon the diversity-factors determined for the Chicago system, will serve to illustrate this. The average small-store customer in Chicago has a local demand of approximately one kilowatt; the average local residence has a demand of 0.4 kilowatt. Thus 2.5 residence customers make the same draft upon the local distributing system in the block that is made by one store customer. The 2.5 residence customers, however, make a demand of only 0.36 kilowatt on the transformer, whereas the store customer makes a demand of 0.62 kilowatt on the transformer. At the generating station the residence customers make a demand of only 0.25 kilowatt, while the store customer makes a demand of 0.38 kilowatt. The residence customers whose local demand aggregates one kilowatt therefore only require about 60 per cent as much powerhouse, substation and distribution-line capacity as the store customer. While the plant and distributing investment in the residence group is only about 60 per cent of that required for the small store, the meter investment for the residence group is twice as great as that for the small store. The income from the small store is approximately twice that from the residence group. This is partly due to the fact that many small stores are now equipped with tungsten posts on the street in front, which burn long hours and which have materially increased the average consumption of this class of customer.

The cost of service to the large user is made up of a radically different balance of parts, since the proportion due to distributing system is very much less and the proportion due to this class of customer varies somewhat with the nature of the business; but for a general manufacturing business the shape of the load curve is fairly well represented by that shown in Fig. 4, which is based upon hourly consumption in a plant having a maximum of approximately 155 kilowatts. It will be noted that this maximum occurs in the morning; whereas the load at 5:00 p. m. is down

to 125 kilowatts, making a diversity-factor of approximately 80 per cent.

Two special classes of customers which have been developed rapidly in the last year or two are of special interest in this connection. These are the ice-making business and electric-vehicle charging. These lines of business have been developed as a result of a rate which gives preference to electricity used during the off-peak hours. These customers agree not to use the bulk of their service between 4:00 p. m. and 8:00 p. m., and printing meter attachments make a record from which the curve in Fig. 5 is made up. On account of the ability of these classes of business to use their energy off the peak, no generating station capacity is required to supply that portion of their load which is kept off peak, and, therefore, a reduced primary charge can be made which permits electric service to be used for the manufacture of ice to the advantage of both manufacturer and central station. The battery-charging load has been developed in the same way because the charging of electric trucks, which are in service on the street during the day, can be done during the night.

The reduction of the cost of electricity, together with the general reliability of electric trucks, has produced a large increase in this business, which is still growing. The growth of the ice business is illustrated in Fig. 6, which shows the maximum load and kilowatt-hour consumption of eight ice plants monthly. It will be seen that this business has grown from 1,900 kilowatts to nearly 2,600 kilowatts during the past year, and that the monthly consumption during the three summer months is amounting to about 1,500,000 kilowatt-hours. This business is off-peak in two respects. It uses no energy between the hours of 4 and 8 p. m. from October 15 to March 1; and the amount of ice produced during the winter months reduces the maximum to approximately 30 per cent of the summer maximum. This reduces the demand on the distributing system as well as on the generating system at the time when the general load is heaviest.

The investment costs for a general manufacturing plant, ice manufacturing plant, and a battery-charging station are shown in Fig. 7. It will be seen that the cost of plant to serve the general manufacturing business is made up largely of generating and substation expense; while the cost of the ice manufacturing plant contains no item for generating expense, and a smaller item for substation and distribution than is required for the manufacturing plant. The battery-charging plant is also entirely off-peak, as none of the load is used between 4:00 p. m. and 8:00 p. m. It makes a somewhat smaller demand on the distributing system than the ice plant, as its load does not come up until about 10:00 p. m.

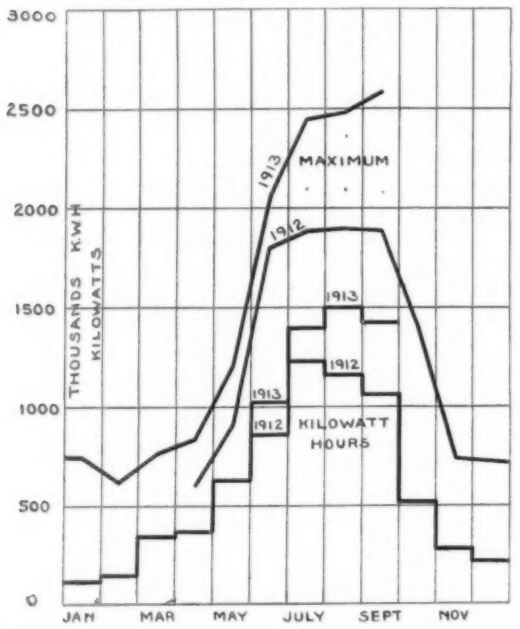


Fig. 6.—Maximum Load and Energy Consumption for Eight Ice Plants.

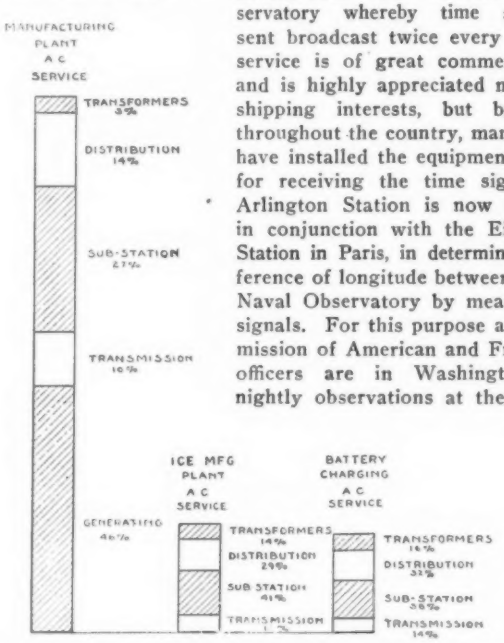


Fig. 7.—Investment for Supplying Different Classes of Large Power Users.

The marine steam turbines being built for the new Cunard ocean liner *Oquitania* will be the largest of their type ever constructed and embody the latest ideas in marine engineering. Each of the four propeller shafts will have a main turbine for driving ahead and an independent turbine for going astern.

The Secretary of the Navy's Report.

The annual report of the Secretary of the Navy was sent to Congress on December 1. It recommends the following building program for this year: Two dreadnoughts; eight torpedo-boat destroyers; three submarines.

Respecting the radio service, the report says: "The new radio service has become an important part of the Navy. Twenty-three radio stations have been established and opened to public business. The high-power radio station at Arlington is in successful operation, and is now used for communicating with other naval radio stations, and also as a time-signal station, connections having been made with the Naval Observatory whereby time signals are sent broadcast twice every day. This service is of great commercial value, and is highly appreciated not only by shipping interests, but by jewelers throughout the country, many of whom have installed the equipment necessary for receiving the time signals. The Arlington Station is now being used in conjunction with the Eiffel Tower Station in Paris, in determining the difference of longitude between it and our Naval Observatory by means of radio signals. For this purpose a joint commission of American and French naval officers are in Washington, taking nightly observations at these two observatories. In connection with this work it is expected to be able to determine the velocity of propagation of Hertzian waves. This is a work of great scientic importance and it is expected to lead to very practical results in determining the longitudes of hydrographic survey bases, observatories, etc. It will enable the department to determine the longitude of points on the routes to the Panama Canal in both oceans with great accuracy, with the Naval Observatory as the base, and possibly, by co-operating with other Governments, to encircle the globe in the important work of verifying the longitude of many places, supplementing and extending the work done by officers of the Navy in the past when the submarine cable was used to connect remote points on the earth's surface."

Regarding the use of wireless in Arctic exploration, the Secretary of the Navy says, as to the Crocker Land Expedition to the Polar regions:

"The expedition sailed from New York on the steam whaler *Diana*, July 2, 1913, reaching Flagler Bay on the west coast of Greenland August 20, where the erection of permanent headquarters and a radio station was established. Chief Electrician Theodore Allen, United States Navy, will remain at this point and conduct various experiments in radio work. The party will then push forward to Cape Hubbard, where a secondary base will be established. The start for Crocker Land will commence in February, 1914."

The electrically propelled collier *Jupiter* is referred to, and the lighting of vessels taken up.

"Thorough consideration has been given the subject of improving the lighting and wiring of ships, with the result that leaded and armored conductors have been adopted instead of plain conductors run in conduit, and that lighting fixtures have undergone complete redesign. In the consideration of this subject the co-operation of the foremost lighting engineers of the country was secured and their suggestions given the fullest consideration, and it is believed that the progress which has already been made will result in greatly improving the lighting conditions on board ship.

The efforts that have been made to reduce the cost of searchlight mirrors by purchasing them in quantity sufficient to meet the demands of the fleet for a period of time have not only effected this purpose, but have also resulted in the production of mirrors in this country which it is confidently expected will be equal in efficiency to those formerly purchased abroad. This is a matter of no small military importance, but as it is accompanied by a marked reduction in cost, the commercial aspect of the case is none the less gratifying."

Lighting of the Cleveland Art Loan Exposition.

For the first time on record, the best in art has been combined with the best in lighting. The collection of paintings on display at the Cleveland Art Loan Exposition, is illuminated by a scientifically designed installation which marks a new era in the lighting of art galleries.

Fig. 1 will serve to give an idea of the lighting scheme. A trough designed to contain the lamps was placed above and in front of the paintings in such a manner that under ordinary conditions the light sources are entirely cut off from the view of the observer; the images of the lamps cannot be reflected into the eye from the glass covering the pictures, unless the latter are hung above the prescribed mounting line. This is shown in Fig. 1, since the angle of incidence *A* is always equal to the angle of reflection *A*. This trough is not used as a reflector, but on the contrary the inner surface is painted dead black. A line of conduit, with outlets so arranged that lamps are spaced at intervals of one foot, runs inside of the trough, the trough concealing the conduit from view. Every alternate socket is equipped with a 40-watt, 105-volt Mazda lamp in a Holophone D'Olier half shade; colored lamps, individually selected, and dipped in a color corresponding to the predominating tone in each picture, are placed in the remaining sockets. The reflector can be rotated about the axis of the lamp, all lamps being placed horizontally. This proves a very flexible arrangement for distributing the light upon any desired part of the picture. The line voltage is approximately 116 volts, but as the Exposition requires light 12 hours a day for only 25 days, it is more economical to install 40-watt lamps which will reach the end of their useful life by the time of the closing of the Exposition than to use 60-watt lamps of normal rating. The color value of the 40-watt lamps, burning at overvoltage, is considerably better than would have been secured if 60-watt lamps, operating at normal voltage, had been used.

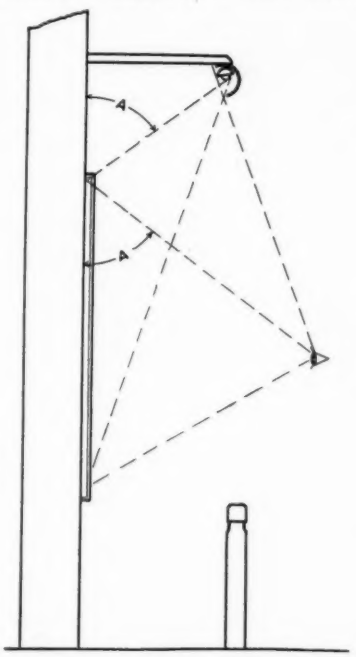


Fig. 1.—Arrangement for Lighting Pictures.

Throughout the entire Exposition, great care has been used to illuminate each painting with light of the color particularly adapted to bring out the tones of that individual painting. The result is pleasing in the extreme; many of the paintings appear to better advantage under the artificial light than they do when viewed in daylight. This is especially true in the case of early morning, or evening pictures.

The installation was designed by the Engineering Department and Physical Laboratory of the National Lamp Works of General Electric Company.

British Awakening to the Advantages of Electric Vehicles.

There has been a good deal of discussion recently in the United Kingdom as to the possibility of an extended use of electrically driven vehicles for private and commercial purposes. In a recent number of the *Commercial Motor* appeared an article entitled "The New Cause for the Battery Wagon," in which the prediction is made that electricity will be found to be the most desirable motive power for vehicles which are to be used in towns for comparatively short journeys requiring stops. Part of the article follows:

The failure, so far, of the electric battery vehicle to attain anything like general adoption in this country is due to many circumstances, the primary cause being the short life of the batteries that have hitherto been available. At the same time some blame probably rests with British manufacturers, who can not be said to have studied the requirements so diligently as our cousins on the other side of the Atlantic.

The Americans, it must be admitted, have shown more enterprise in this matter than we have, with the result that they have produced batteries of the lead type which are sufficiently successful to warrant repeat orders by large users of commercial vehicles. There are in Great Britain at present signs that this type of car will be given a further trial, and it behooves all battery manufacturers to study the subject carefully, so that they may have their share of the prospective business.

There are further reasons than those given for the non-development of the electric vehicle in England. All the early vehicles were made at a time when electrical design had not settled down into accepted grooves. Hence, not only were motors inefficient as regards actual consumption, but the cars were very far from perfect mechanically. Crude transmission, consumptive storage cells, bad financial management, and an external appearance which was even then archaic prevented

the extensive use of the electric car for years. Moreover, the petrol vehicle and its steam competitor were becoming popular. The price of petrol, however, has steadily risen since then, and appears unlikely to fall to its original level; and this increases the interest in a vehicle using power which costs less per ton-mile than any other form of energy available, and is going lower and lower in price as electric power stations come more widely into operation.

The same plodding work that advanced the petrol and steam cars has never been done by the sponsors for the electric over here. Granted, however, that the time is now ripe for a revival of battery motor transport, it is essential to secure lasting success that the case for the electric should not be overstated. It can do some things far better and more cheaply, too, than any other type of chassis. If claims of superiority are confined to the present possibilities of electrics, failure will hardly be possible; for the Britisher, if slow to take up new things, is, on the other hand, loyal in his support of things his experience proves to be sound.

The revival of the use of the electric car is further advanced than is generally known. The development has started with pleasure cars, one British firm having decided to devote one-third of its new works at Paisley to the manufacture of a high-grade chassis which will be equipped with an Edison storage battery. Twelve hundred of these cars will be made at first, and it is anticipated that they will mark a notable step forward in combining first-rate engineering practice, fine body work, and reasonable price.

Other schemes are on foot, but they are not sufficiently advanced so that details can be disclosed. Evidently, too, the large commercial houses are becoming interested in the possibilities of electric vehicles. A number of more prominent houses, including Liberty's, Whiteley's, Selfridge's and Harrod's, have made extensive tests of Edison battery cars, and Harrod's has acquired four of these vehicles for further experimental tests. Messrs. Liberty have also decided to try electrics and have ordered their first vehicle. Much interest has been manifested by corporations in cars for ambulance, fire and electricity departments, and the time is near when the electric car will be looked on as a *sine qua non* for all services where moderate speed combined with lowest possible running costs are important factors. The corporation engineer of Glasgow has purchased a one-ton Edison van, which has so far given complete satisfaction.

On the same subject as dealt with in the foregoing article are some comments made by the United States consul in Birmingham and published in a recent number of the *Daily Consular and Trade Reports*. He says that the British market now appears to be in a condition where well made American vehicles could be introduced with prospects of profit. However, there will be the same need in this case for careful salesmanship and study of British practices and prejudices as there is in introducing all other foreign products

Some time ago the Edison batteries were brought to England, and one company which manufactures gasoline-driven vehicles has produced a closed electric vehicle. This was driven from Dumfried in Scotland, starting June 9, through Penrith, Kendall, Preston, Manchester, Birmingham, Coventry, and other cities to London, where it arrived on Wednesday, June 11, stops having been made en route for rests and the recharging of batteries. An account of this trip was published in our issue of July 19, page 108.

It is interesting to note that the attitude of those supplying electricity was very favorable to the vehicle, which promises that when the use of electric vehicles warrants it practical steps will be taken to provide for the charging of such vehicles and to fix charging rates which will make electric vehicles commercially possible. With the high price of gasoline, and the prospect that it will not be reduced for some time, but may increase, this would seem to be the moment for entering the market. It should be remembered however, that one British company has already started the manufacture of electric vehicles and that others are certain to follow, if the market is promising.

The manager of the Birmingham City Electric Supply Department has informed Consul Albert Halstead that he would recommend special rates for charging electric vehicles between midnight and 6 a. m., when the demand for current is lowest. These charges, it appears, would be irrespective of the amount of current taken. In other words, the general practice of varying the rates according to the amount taken would at first not be allowed. This is only a proposed action and is not definite, and it is impossible to state what the charge would be, but the impression is that the rate would be about one-fifth of a penny (0.4 cent) per unit, the present charge being one penny (two cents) per kilowatt-watt. The city does not propose to provide charging stations itself, but the idea is that one or more garages should undertake the charging of batteries for users of electric vehicles.

The managing director of a Birmingham garage who has become interested in the subject has ordered one of the English vehicles referred to. On being told that he should have conferred with the American consul before doing anything and that many American electric vehicles on the market in the United States were eminently suited for this market, he indicated his interest in the subject. He doubtless would be glad to hear from American manufacturers. He stated that he would be prepared to charge electric batteries if the vehicles were put on this market.

This attitude on the part of an enterprising garage strikes one as being most encouraging and has confirmed the impression that as soon as the demand occurs, electric supply authorities throughout the United Kingdom will be prepared to make satisfactory arrangements and rates to encourage the use of electric motor cars.

Along the same lines, United States Consul W. C. Hamm, of Newcastle, states that the electric motor car has not yet been placed on the market there, but a test was recently made with an electric car and it is reported to have done exceedingly well, running 80 miles on a single charge and 1,000 miles altogether. A. Johnson & Company, Limited, of Paisley, Scotland, have just finished a large factory in that place for the manufacture of electric motor cars. If American makers of electrics wish to find a market for their manufactures they should be stirring before the Paisley firm occupies the ground.

Selection of Electric Motors for Steel-Mill Service.

On the evening of December 2 a paper was read before the mechanical section of the Engineers' Society of Western Pennsylvania, at Pittsburgh, Pa., on the 'Selection of Electric Motors—Minimum Maintenance and Repairs," by James Dixon, construction engineer for the Crocker-Wheeler Company, Ampere, N. J. The paper was prepared primarily from the steel-mill point of view.

The electrical features of a motor are usually dictated by the service for which it is intended. In steel-mill service it must be designed for intermittent service, with frequent starts and stops, severe overloads, and no chance to polish the commutator by running without load, as is the case with railway motors. In general, a straight series motor is used, although there are some advantages and no disadvantages attached to the addition of a light shunt field, the motor being then known as a series-shunt motor. The principal function of the shunt field is to prevent overspeed at light loads. It also provides a field flux for the armature to pull against in case of sudden loads, or quick starting, preventing excessive

current rushes. The torque is proportional to the product of the field flux into the armature flux. On a sudden load it takes an appreciable length of time, say one-fifth of a second, for the field flux of a series motor to build up to one-half its normal value, and nearly three seconds to reach full value. The first rush of current thus produces little torque, but has full heating effect. With a shunt field, the torque is developed more quickly, and the current required at the start is considerably less.

The mechanical requirements are: good mechanical proportions, ample bearings, shafts, bolts, frames, etc.; a good finish, since a workmanlike finish is only put on good materials; simplicity, including a small number of parts, whose functions are readily understandable; good operating features, including self-feeding brushes, self-oiling bearings, tight bolts, good electrical connections, etc.; accessibility for inspection and repairs; interchangeability, since standardization of parts means sustained quality.

The early motors for this service were simply railway motors adapted to the specific application. Electrically these motors were satisfactory, but they were mechanically inadequate, and as a result of the experiences secured with these motors, the present rugged capable and simple lines of mill motors have been developed, through the co-operation of the steel-mill operators and the electrical manufacturers. The strictest interchangeability of field coils, brush gear, etc., has been attained and the insulation has been made practically incombustible by the use of mica, asbestos and the best grades of baking varnishes.

Practically all mill motors are geared. The ordinary spur gear causes severe vibration, and greatly reduced repairs to bearings, commutators and shafts have been secured by the use of herringbone gears.

The steel manufacturer is slow to make a change—especially when the apparatus in use is satisfactory. His motor is a big, liberally designed machine, with fairly good commutating characteristics, and in some quarters the interpole is not favored, it being considered only as an aid to commutation in a machine so closely designed that it would not work at all without the interpole. The mill motor is simpler without the interpole, and setting of the brushes does not have to be so accurately adjusted. Furthermore the interpole flux lags behind the current, on a sudden increase or decrease of load, so that just when it is needed most, it does not have the correct value.

The initial cost of mill motors is usually small compared to their maintenance cost, and the total cost during their useful life is the correct thing by which to judge the usefulness of a motor. Breakdowns are inevitable in machinery which is worked to the limit, but the cost of a breakdown includes the loss of production, as well as repairs, and only the most reliable apparatus should be used.

Dirt, the natural enemy of insulation, cannot be avoided around a steel mill, but should be rigidly excluded from the repair shop, where cleanliness and order should be the rule. Best results are usually obtained by keeping the maintenance and repair departments entirely separate. In this way there is less tendency toward makeshift repairs, intended solely to keep things going temporarily. The function of the maintenance department is to keep the apparatus in good condition, and thus prevent breakdowns. Good maintenance records, properly studied and analyzed, are of material assistance in this work. Records should be kept of a certain location rather than of the individual machines, and should include dates of oiling and inspection, causes of breakdown, nature of repairs, etc. The value of these records lies in the indication they give as to whether the apparatus used is really the most economic, by calling attention to the locations and driven machines which give most trouble.

The discussion of the paper was participated in by Geo. H. Neilson, A. C. Cummings, A. G. Ahrens, J. M Hipple, A. C. Lanier, C. J. Mundo, Ludwig Hummel, B. W. Gilson, H. B. Smith and D. A. Detweiler. Mr. Cummings stated that herringbone gears had been almost universally successful in stopping trouble, and for his company had reduced armature burn outs from one every three weeks to about one in a year. By using a hobbing machine, their cost was only slightly greater than spur gears. Mr. Ahrens said that most gear trouble was due to poorly cut gears, and bad alinement. Motors of more than 25 or 30 horsepower require outboard bearings to prevent vibration. The modern mill motors are liberally designed, and are in every way adapted to the most severe service conditions.

Mr. Hipple objected to the statement that the commutating pole is useful only to bolster up a bad design. In his opinion, the introduction of the commutating pole is the one great advance which has been made in direct-current practice in the past twelve years, and when properly used, is a prime factor in design, giving a much better proportioned motor. Of course, if commutating poles are inserted in motors not designed for them, the results may not be satisfactory. With regard to the necessity for fine brush adjustments, most commutating-pole motors are built without brush adjustments, so that it is easy to put the brushes back in their exact location when they are taken out for repairs. So far as simplicity is concerned, the field coils seldom burn out, and as they improve commutation, the net result is less repairs. The lag of the flux in the commutating pole behind the current is purely theoretical, since the poles are always laminated, and with a liberal design, no bad effects are noticed from this source.

Mr. Lanier commented on the closeness with which motor applications and design have gone together. Improved design has justified more severe service, which has in turn called for still further improvements in motor characteristics. The sudden rush of current before the field is built up at the start, spoken of by Mr. Dixon, is largely held down by the self-induction, when the conductors are surrounded by iron as in the mill motor. Saturation of the commutating poles is seldom ever approached, as they are usually worked at only about one-third the density of the main poles.

Mr. Mundo gave as his opinion that adding interpoles is the last word in making successful an already very well designed motor, which has to meet exceptionally severe conditions. In answer to a question, Mr. Hipple stated that if the voltage is absolutely constant, and the load steady and not exceeding full load, the non-cummutating-pole motor is justified, if it can be secured cheaper. But if the voltage is variable, or if there are occasional overloads the commutating-pole motor should be used.

Protecting the Eyes from Excessive Radiation.

In a lecture before the Royal Society of London, Sir William Crookes described some experiments to find a glass which would cut off the radiation which has proved so injurious to the eyes of glass workers. He tested over 300 glasses and among them found three which respectively cut off 90 per cent of invisible radiation, are opaque to ultra-violet rays, and sufficiently free from color to be used as spectacles; but he has not yet been able to combine these qualities in a single glass. The ideal glass for this purpose has yet to be discovered.

Copper Exports.

Exports of copper for the week ended December 1 totaled 11,046 tons; since December 1, 6,571 tons; same period last year, 5,850 tons.

New England Meeting for Co-Operation.

A "get-together" meeting of electrical men of New England was held under auspices of a committee of the New England Section, National Electric Light Association, at the American House, Boston, December 5. James D. Andrew, of the Boston Edison Company, presided.

E. R. Davenport, of Providence, R. I., read a paper in which he advocated the policy of central stations abandoning the practice of giving free renewals of lamps and also free first installations. His company, the Narragansett Company, renews only carbon-filament lamps, charging for other types. Most devices are sold at a fair profit to the company.

Mr. Davenport held that free renewals are a species of discrimination and are liable to furnish a subject for the action of public service commissions. In the matter of gas lighting, Mr. Davenport said, the cost of mantles is seldom given a thought by the customer. The monthly bill is the sole consideration. The speaker considered the free furnishing of lamps as open to objection as the gratuitous providing of customers with motors or any other electrical apparatus. In some cases a company might with advantage reduce its price for current to the extent of its present cost of renewals, doing away with the latter.

Mr. Davenport said that fears that the introduction of improved lamps will reduce central stations' income are groundless; with low-wattage tungsten and nitrogen-filled lamps the consumption per customer will actually increase. He also held that some company's practice of burning lamps at less than the rated voltage is bad policy. He urged that the use of small lamps be fostered rather than discouraged, and it will cause customers, particulary storekeepers, to cease their insistance that lamps be turned off when they are not absolutely needed.

Referring to the policy being pursued by companies in the West, in the matter of renewals, Mr. Davenport stated that most companies now furnish neither free first installations nor renewals, but sell all supplies at a profit. The Minneapolis General Electric Company is a conspicuous example. An operating company serving a number of cities in the Southwest makes some free installations and renewals, because of franchise requirements, but is reported to be doing away with this practice so far as possible.

"Electrical contractors should handle lamps of all improved types, and they should be as easily obtainable by consumers as are gas mantles," said Mr. Davenport.

F. S. Price, of Pettingell-Andrews Company, Boston, said that to secure the best results all central stations should hold membership in the National Electric Light Association and all contractors should belong to the National Electrical Contractors' Association. These organizations do invaluable work, each in its own field, while the Society for Electrical Development embraces all branches of the industry.

H. R. Hixon, of the Hixon Electric Company, Boston, believed that the increase of mutual confidence and a firmer grasp of the advantages of cooperation will work wonders for the electrical industry in New England.

J. M. Wakeman, general manager of the Society for Electrical Development, outlined the advantages of membership in that organization. He stated that the society insures a balance between the several factors interested and that no one branch can dominate in it. Pointing out that only 20 per cent of all houses in the country which are within reach of electric service are wired for electricity, Mr. Wakeman said that the objective of the Association is the development of this latent market.

The Society's activities were described: (1) the educational compaign through popular magazines; (2) articles on electric equipment of factories, to appear in trade papers; (3) moving-picture films showing the advantages of elecricity in the home, factory and on the farm, these to be displayed through the regular exchanges; (4) a demonstration car equipped with electrical devices, to be accompanied by a demonstrator as it moves from one town or city to another.

C. D. Williams, of the Simplex Electric Heating Company, urged that the work of the present committee in charge of the "get-together" meetings be perpetuated, and stated that it is the intention of the committee to hold a meeting monthly with one or two topics for discussion.

L. D. Gibbs, vice-president of the New England Section, N. E. L. A., pointed out the desirability of all electrical men in New England supporting the meetings, the only cost being the price of dinner tickets for the dinner following the meetings. It was voted to continue on lines laid down by the committee.

St. John Morgan, H. T. Sands, and W. G. Stetson also spoke.

The later evening was devoted to a dinner, at which the guests were entertained with moving pictures of subjects of interest to electrical men.

STEAM BOILER WORKING IN ELECTRICAL POWER STATIONS.[1]

By J. W. Jackson.

An important consideration in the case of boilers for central power stations is the liveliness of the boiler for dealing with variations in the load. The result of this is that the water-tube boiler has been adopted almost universally; at least eight of the leading makes of water-tube boilers will permit of steam being raised from cold water to the full working pressure in about 30 minutes, whereas with the big cylindrical type of boiler several hours are required for this purpose.

Circulators have been developed to overcome this difficulty with the cylindrical boiler and are undoubtedly doing good work, but even with circulators the boiler is still very much handicapped, while the ordinary Lancashire type of boiler does not permit of forcing to the same degree as the water-tube boiler.

In connection with the design of superheaters, modern competition appears to have called for a superheater of smaller area but placed in a much hotter portion of the boiler, with the natural result that the superheater tubes are overheated, and will therefore have only a short life. In addition to this, difficulty is experienced in keeping the tubes in position. This is undoubtedly a mistake. Superheaters which were designed 10 years ago with ample surface were fixed much further from the furnace as in Fig. 1, with the result that they are much steadier to work and of almost everlasting wear. They also have the advantage that the amount of superheat can be reduced without overheating the tubes. The more modern superheater (Fig. 2) does not usually vary the path of the gases, but shunts more of the saturated steam past the superheater. A smaller quantity of steam passing through the superheater, less heat is transmitted to the steam, thereby allowing the superheater-tube temperature to rise so high that corrosion or oxidization occurs inside and outside the tube. The new superheater can be made considerably cheaper, but the difficulties in operation are increased as regards maintenance, reliability, and control. The scheme usually means that the modern superheater is fixed between the main water tubes of the boiler, with the result that "sooting" of the tubes becomes a difficult matter; when portions of the path of the gases become clogged with soot the gases are then concentrated on the narrow pas-

1 Portion of paper read before the Newcastle (England) Section of the Institution of Electrical Engineers, November 10, 1913.

sages, with the result that a greater amount of heat is brought to bear on those portions, which causes more rapid oxidization of the metal, and so shortens its life. This clogging of the gas passages continues until the amount of superheat falls to a comparatively low figure. This trouble is one that requires most careful consideration when the lower grades of fuel are handled. The more generous superheater fixed beyond the first bank of tubes being of ample size for its work, because of the lower temperature of the gases, is much less sensitive to the fouling of the passages by soot.

We are undoubtedly at the beginning of the period when really high superheated steam is coming into use, and steam temperatures of from 700 to possibly 900 degrees Fahrenheit at the turbine stop valves are likely to be required before very long. Under these conditions it will be seen that if the superheater of the future is fitted in such a hot position of the boiler as in the case of some existing superheaters, troubles will increase. If a superheater tube is bent so that it cannot drain itself at the bottom, serious corrosion or possibly complete clogging of the tube is liable to occur; but even this trouble can be lessened if the superheater is kept well up in the boiler, so that it does not normally become flooded when the boiler is at rest. Here again, Fig. 1 offers a good solution, as owing to the gas by-passing the superheater there is no danger of the latter being flooded or of its being overheated when starting the boiler. Fig. 3 is a good design when kept well up above the water level. There is always a considerable amount of risk with a superheater that has to be blown out before the boiler can be put on load, and from this point of view alone it is advisable to stipulate that the superheaters be kept well up above the boiler water-line, and also that the superheater be considered, so far as operation is concerned, a portion of the main steam pipe; that is to say, that the boiler should not be fitted for the main steam with a main saturater steam pipe arrangement.

Another trouble with the modern superheater is that owing to its comparatively small surface a considerable drop in pressure takes place when the boiler is being worked at its normal full load, this drop amounting to as much as 10 to 15 pounds per square inch at the normal full-load rate of working, whereas with the older superheater a drop of about 5 to 7 pounds takes place. The difficulty of overhauling and cleaning the exterior of the modern superheater is also considerable, this being due to the narrow space provided, it being almost impossible for a man to get into the space and carry out the necessary work. The older superheater being fixed at the top of the boiler allows of the superheater casing being dismantled entirely, so giving very thorough and complete access.

With regard to the position of the main steam drum or drums, some consideration is required as to the position at which the water-gauge fittings are to be attached. If the drums are placed parallel to the path of the gases, then the front of the drum should be set at a higher level than the back of the drum, while if the drums are at right angles to the flow of the gases the front drum should be elevated and the back drum lowered, in comparison with the level of the center drum. In actual practice, in the case of a boiler with three drums set at right angles to the flow of the gases, the length of the boiler from the front to the back being about 16 feet, there is a difference in the water levels between the back drum and the front drum of as much as 12 inches when the boiler is being steamed at normal full load. The reason for this is not difficult to see. It will be remembered that nearly 75 per cent of the total evaporation of the boiler takes place in the front two or three rows of tubes. The bubbles of steam, rising up the tubes at a fairly high rate, displace the water in the tube, and so set up a rapid circulation; moreover, the water in the front drum is quite full of large and small bubbles of steam, which have the effect of lowering the density of the water; and, further, friction is set up in the water-circulating tubes by the water flowing from the front drum to the middle and back drums to repeat again the cycle of circulation. There does not appear to be any disadvantage whatever in elevating the front drum by as great an amount as that indicated. In elevating the front drum by 12 inches above the level of the back drum it will, of course, be seen that a fairly long water-gauge glass is required to cover fully the variation in water levels. This, however, is an advantage rather than otherwise, and in following this scheme out a lower water level can be maintained with much greater safety than is at present experienced; that is to say, by elevating the front drum the water level throughout all the drums will be the same mean level under working conditions, and by carrying as small a quantity of water in the drums as is reasonably safe, greater

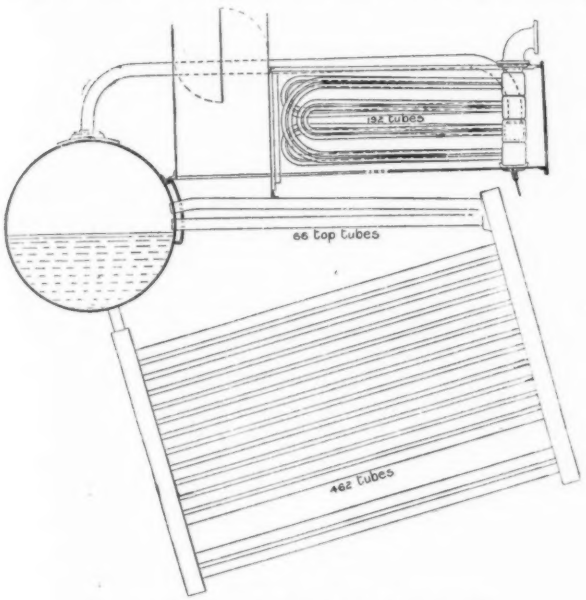


Fig. 1.—Old Method of Applying Superheaters.

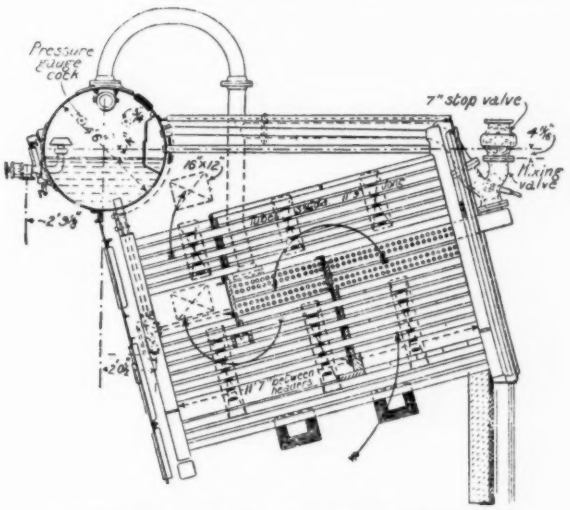


Fig. 2.—Modern Method of Installing Superheater.

freedom from priming, when dirty water is carried, is obtained. This question of priming is of great importance, whether the steam is required for reciprocating engines or turbines, and any scheme that can be put forward for reducing this difficulty must receive attention.

Another difficulty in connection with priming is the corrosion of the steam space of the drums and of the steam and superheater tubes. The steam rising from the water surface heavily charged with moisture comes in contact with the heated surfaces of the upper portion of the drum and steam-connecting and superheater tubes, and is liable to set up very serious corrosion, which in a comparatively short time will completely destroy the tubes. It is quite easy to overcome this trouble, so far as the drums are concerned, by painting the internal surfaces of the drums with any of the first-class bituminastic paints that are now on the market.

Boiler Furnace.

One of the most notable advances made in the present-day steam boiler is that of smokeless working with ordinary bituminous and low-grade coals.

With the modern water-tube boiler a very large combustion space is provided, and a great deal of this combustion space is lined with a refractory material, high-grade firebricks usually being employed for this purpose. The firebrick becomes heated up to a fairly high temperature, but being sufficiently far removed from the heart of the flame it does not suffer at a prohibitive rate, and so allows combustion to be almost completed before the heated gases are allowed to come in contact with the comparatively cold metal surfaces.

Another important reason for the smokelessness of the modern boiler is, of course, the mechanical stoker, where the fuel is gradually heated up at a comparatively slow rate or in comparatively small quantities, so that there is no great rush of gas into the furnace at any moment. This scheme of making the furnaces with refractory linings becomes of considerable importance when low-grade fuel has to be employed, as unless the furnace temperature is maintained this fuel cannot be dealt with.

Air leakages into the furnace are of very considerable importance, and this question probably requires the largest amount of attention in boiler working from the point of view of efficiency. With the ordinary induced-draft system, air leakages can occur over very wide areas, and it is often an extremely difficult task to ascertain the starting point of the leak. One of the best illustrations of the effect of air leakage on boiler furnace brickwork can be seen on boilers using gas firing, where practically the whole of the furnace brickwork is heated up to almost the same temperature. Those places at which air leakage occurs show up as black spaces over the brickwork inside the furnace. Again, in the case of a chain-grate stoker using coal with a calorific value of something less than 10,000 British thermal units per pound, an air leakage into the furnace towards the front end of the boiler has such a bad effect on some grades of coal as quite to put the fire out if an attempt is made to drive the boiler at even the normal rate of working.

A new page in boiler history was recently opened by Professor Bone and Dr. Nicholson. The particular line of

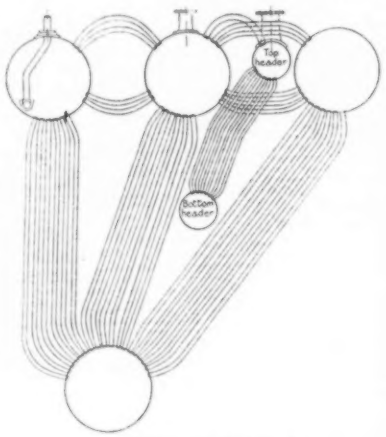


Diagram of Piping.

research adopted by Professor Bone has been that of surface combustion. In this case the ordinary furnace is eliminated, but at present the apparatus has only been designed for use with cylindrical type of boiler of very short length, combustion taking place within the fire tubes.

Dr. Nicholson's scheme can apparently be applied to any of the usual commercial boilers by rearranging the gas paths. The furnace remains much the same as before, the chief idea being to pass the gases after combustion over the heating surfaces at a very high rate of speed. In the case of Lancashire and Cornish boilers the furnace tube for a portion of its length is fitted with a firebrick plug, leaving a very narrow space between the plug and the heating surfaces for the gases to be forced through. In passing the gases over the heating surfaces at this high rate of speed a considerable number of eddies are formed, with the result that the film of comparatively cold gas is driven away from the heating surface, thereby permitting a more ready transference of heat. The other great advantage of this scheme is that owing to the high speed at which the gases flow it is possible to reduce the temperature of the outlet gases to below 200 degrees Fahrenheit. It is stated that owing to the gases being carried over the heating surfaces at such a high rate of speed no corrosion due to the condensation of sulphuric acid takes place in either Professor Bone's or Dr. Nicholson's schemes. So far as can be seen at the present time, it is possible for the overall efficiency of a commercial boiler to be improved by from 2 to 7 per cent over the best modern boiler practice. Dr. Nicholson's scheme requires a very considerable amount of power in producing the necessary draft.

Power-Plant Efficiencies: Present and Future.

J. A. Robertson, in addressing the Scottish Local Section of the Institution of Electrical Engineers, of which he is chairman, on November 11, said that the present period was one of extremely rapid development in the multifarious applications of electricity and questions which a few years ago appeared to be in the domain of pure speculation are now claiming attention as practical problems awaiting solution in the near future. Efficient investigation of the natural fuel resources of the country by concentrating the manufacture of power in large central stations and transmitting over areas extending to hundreds of square miles, the abolition of the smoke clouds of our cities and towns, the electrification of railways, the replacing of existing systems of motor transit in our streets, the applications of electricity on a large scale to chemical processes and in the production of iron and steel — these were the coming questions for electrical engineers.

Mr. Robertson mentioned some of the recent developments which had brought these questions to the front, and proceeded to indicate the existing limitations to further advancement, and to consider in what directions future progress lies.

The modern power station equipped with water-tube boilers and steam turbines represented practically the limit of economy so far as present knowledge goes. A 5,000-kilowatt turbogenerator will deliver a kilowatt-hour at its terminals for about 13.25 pounds of steam at 550 degrees Fahrenheit with 28 inches vacuum at the condenser, while a 10,000-kilowatt set might bring the figures down to 12.5 pounds. This appears to be the limit at present. But with the best modern equipment and with every care taken to prevent loss one can only secure an overall thermal efficiency in the station of about 15 per cent. Thus there is 85 per cent.

loss between the fuel entering the furnace and the electrical energy being delivered at the switchboard. Of this 85 per cent, 30 per cent is attributable to the boiler house in the form of heat lost in the chimney, radiation from boilers and piping, and leakage in the boiler settings and flues. In the turbine 5 per cent is absorbed by friction and radiation, 4 per cent in generator losses, while the remaining 46 per cent is rejected in the form of heat to the condenser. To improve the efficiency of the turbine one must increase its range of temperature and the only practical way to do so at present is by additional superheating of the steam. The difficulty in using high superheat for turbines is purely one of construction, calling for the use of special materials and improved methods of fixing and arranging the parts exposed to the higher temperatures.

Mr. Robertson said that, bearing in mind the tremendous advances which have been made in recent years, there is good ground for believing that these difficulties would also be overcome. In the meantime they constitute the chief limitation to higher efficiency being obtained from the steam turbine. The thermal efficiency of the Diesel engine might be taken at 30 per cent, or twice the efficiency of the water-tube boiler and steam-turbine combination, but the speaker advised British engineers not to adopt plant depending on supplies of oil from foreign countries. For central stations he urged the use of plants operated by coal, of which England would have abundance for many years.

Producer-gas plants can be operated with almost any kind of coal fuel and have a thermal efficiency considerably better than that of the steam turbine. It might be taken at about 27 per cent, or if producer losses are included, there is a combined efficiency of about 24 per cent. Of these losses about 20 per cent are absorbed in the cooling jacket and about 30 per cent ejected to the exhaust pipe. If it were possible to increase the range of temperature and construct gas engines of compound or triple-expansion type, a much higher efficiency could be obtained, but the mechanical defects in the way of making compound gas engines are enormous and these multiplied as the size of the engine increases. The limit at present appears to be single-stage engines of 4,000 horsepower.

There is still room for improvement and the gas engine will play an important part in the central station of the future. If we could combine the mechanical and operating advantages of the steam turbine with the thermal efficiency of the gas engine, we should have a decidedly improved combination.

Combining these types of prime mover in one station would lead to the recovery of a large portion of the heat now rejected to the gas-engine exhaust for the purpose of raising steam in specially constructed boilers, while the heat absorbed in the cylinder water jackets could be recovered as feed water for the steam boiler. Thereby the station efficiency could be raised from about 15 per cent to about 25 per cent.

With such efficiency, and with the further advantages that concentration give in the way of lower first cost and reduction of fixed charges, there is no reason why electricity can not be sold under a scheme such as Mr. Ferranti put forward three years ago, at a price which would enable it to be used for every conceivable industrial and domestic purpose.

Dielectric Hysteresis at High Frequencies.

The December meeting of the Institute of Radio Engineering was held at Columbia University, New York, on the third instant, with an attendance of over one hundred. Vice-president Marriott opened the meeting with a brief address concerning the arrangements which had been made for the transmission of signals of various wave-lengths for the calibration of radio receiving stations in the vicinity of New York. Such uniform calibration will prove useful in determining infractions of the international and federal laws regarding wave-length restrictions.

The paper of the evening, on "Dielectric Hysteresis at Radio Frequencies," was then presented by E. F. W. Alexanderson, of the General Electric Company. The novelty of design in the 100-kilovolt, 100,000-cycle transformer, and the difficulties encountered in its construction and use, as well as data regarding losses in various dielectrics at a number of voltages and high frequencies, proved to be of great interest to the members. A discussion in which there were considered a number of the insulation problems peculiar to radio engineering followed the paper.

The next meeting will be on Janaury 7, 1914, at Fayerweather Hall, Columbia University. There will be announced the results of the election of new officers, and papers on variation of signaling range throughout the year, by R. H. Marriott, of the Department of Commerce Radio Service, and on a new rectifying conductor, by C. Tissot, of the French Admiralty, will be read. All interested in radio transmission are invited to attend.

Effect of Electric Oscillations on Metallic Salts.

When certain metallic salts are fused and permitted to solidify between electrodes which are connected in a circuit with a few storage cells, the conductivity of the metallic salt depends upon the value of the potential difference applied to the electrodes, and upon the presence of electric oscillations. Its properties thus resemble those of a coherer, and such an arrangement may consequently be used as a detector of such electric oscillations.

Experiments to determine the properties of such fused salts have been carried out by C. Tissot, and published in the *Comptes Rendus.* The salts tested were chloride of lead, chloride of thallium, bromide of cadmium, silver nitrate and silver halides. At ordinary temperatures, these salts have a resistance of the order of magnitude of one megohm. This resistance does not change so long as the difference of potential remains below the value of about one volt, but if the voltage is raised, the material becomes more and more conducting, the increase in conductivity being more rapid with a higher voltage. The resistance may decrease, for instance, to a value of a few thousand ohms.

After a higher conductivity has been established, the higher potential difference can be reduced without reducing the conductivity, but in every case if it is exposed to electric oscillations of sufficient intensity, the conductivity disappears immediately. The experiments may be arranged in the way common with coherers, exciting the system from a distance by means of an induction coil and spark gap. The intensity of the oscillations necessary is smaller, the smaller the voltage applied to the system. If a steady difference of potential is maintained, the system regains its conductivity when the oscillations cease. The change in resistance is progressive, the time required being shorter the larger the applied voltage. By a proper choice of values the changes can be made almost instantaneous. Such a detector has been used effectively in receiving wireless signals.

Reading Ice Plant Purchases Power.

The Reading (Pa.) Merchants Ice Company has entered into a contract with the Metropolitan Electric Company to purchase current equivalent to 300 horsepower for the operation of its machinery. It is taken as evidence of the increasing popularity of electricity in ice plants; few such plants in Reading have heretofore been using electricity.

New Electrical and Mechanical Appliances

Two Recently Improved European Electrical Mine-Hoisting Systems.

In order to overcome some difficulties in connection with electric motor drive for cable hoists for mining work, manufacturers have been occupied of late with improved methods which are intended to give a more satisfactory working of motors and generators on the variable loads met with in this class of service. As regards recent European practice in this field this article will describe two different methods which are brought out by the prominent Paris manufacturer, the Compagnie Electro-Mécanique, by the use of the Swiss Brown-Boveri system. Both these methods are in use in mining plants in various parts of the Continent.

The first method consists in the use of direct-current motor drive for the cable hoist on the Leonard system. A good example of it is found in the shaft known as the Mauveschacht situated at the Heinitz mine of Beuthen, in upper Silesia. The cable hoist, Fig. 1, is designed to lift 250 tons an hour, from a 2,500- foot depth. In this case there is mounted a Brown-Boveri-Parsons steam-turbine set in which the turbine drives a direct-current generator for the hoist as well as a three-phase alternator for the general use of the mine. In this method the special generator has a variable excitation, and upon starting up of the cable, a rheostat throws on field current from zero up to full value, so that the current of the machine rises, and with it, the motor speed, this being independent of the load. When the load arrives at the surface, the generator field is cut down to zero in reverse manner and the motor slows down in consequence. At times the steam turbine runs at practically constant speed, regardless of speed changes or stops on the other side.

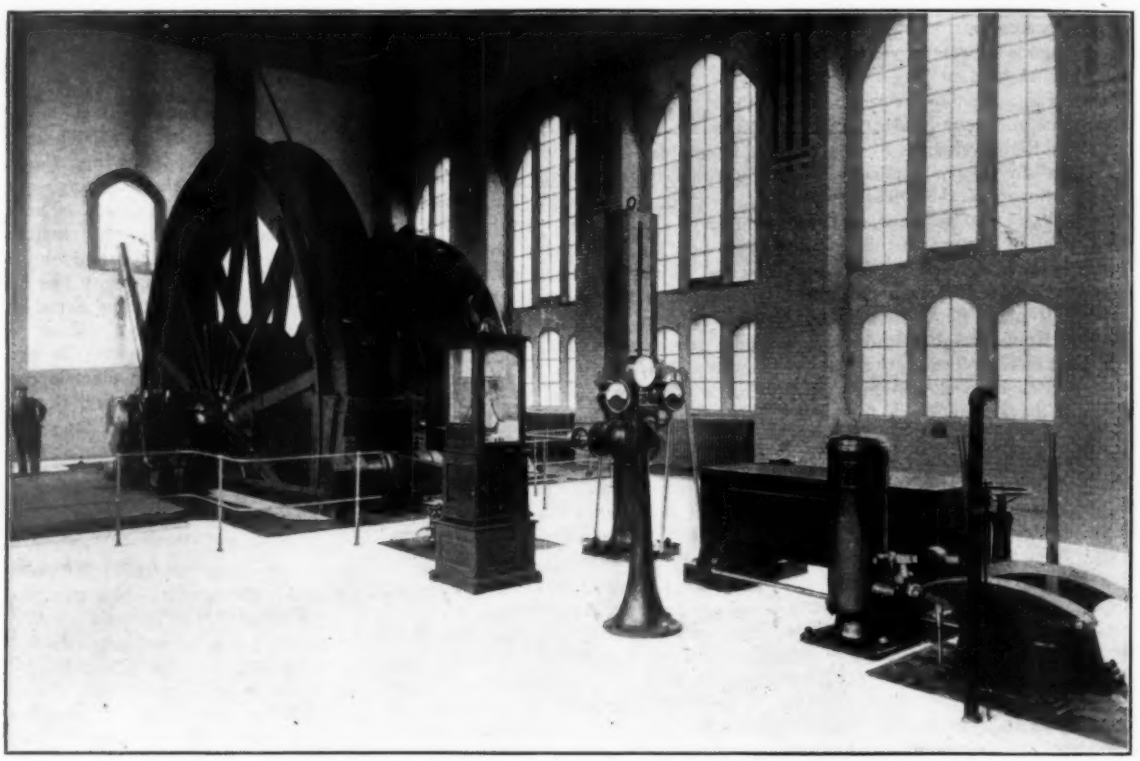


Fig. 1.—Large Direct-Current Motor-Driven Mine Hoist in Mauveschacht Plant, Germany.

The direct-current generator is of 500-kilowatt nominal size, but can be run up to 1,250 kilowatts, with voltage varying from 0 to 500 volts. In this method the variations of power taken by the hoist are directly transmitted to the boilers, which serve as a storage of energy, dispensing with the use of a shock absorber in this connection. By using very exact governing for the turbine its speed variations are kept within very close limits which do not exceed one per cent each way. The turbine has sufficient size to take the average load of the mine hoist and the three-phase alternator, and any overload shocks are taken up by a new device in the way of an automatic overload valve on the steam turbine. In case of peaks in the load due to the cable hoist, this valve opens an extra set of steam-jet orifices in the turbine so as to provide the additional power which is needed at any time. This valve opens and closes by automatic action which depends upon

the difference of steam pressure on either side of the main inlet valve, and the method allows of working with very heavy overloads without variation in the running speed, for the action of the special valve does not depend on the speed of the trubine. The economic yield of such a mine plant is higher than what is given by a rotary converter system, as this latter gives rise to extra losses. Besides, the safety in running is increased by the fact of using a less number of machines. In practice, the special turbo-generator sets of the Brown-Boveri type are found to be all that is required for such plants.

Another plant of this kind installed at a more recent period is at the mines of the Gewerkschaft Niedersachsen at Wathlingen, Germany. The cable drum is driven by a 520-horsepower direct-current motor running on 700 volts at 38 revolutions per minute.

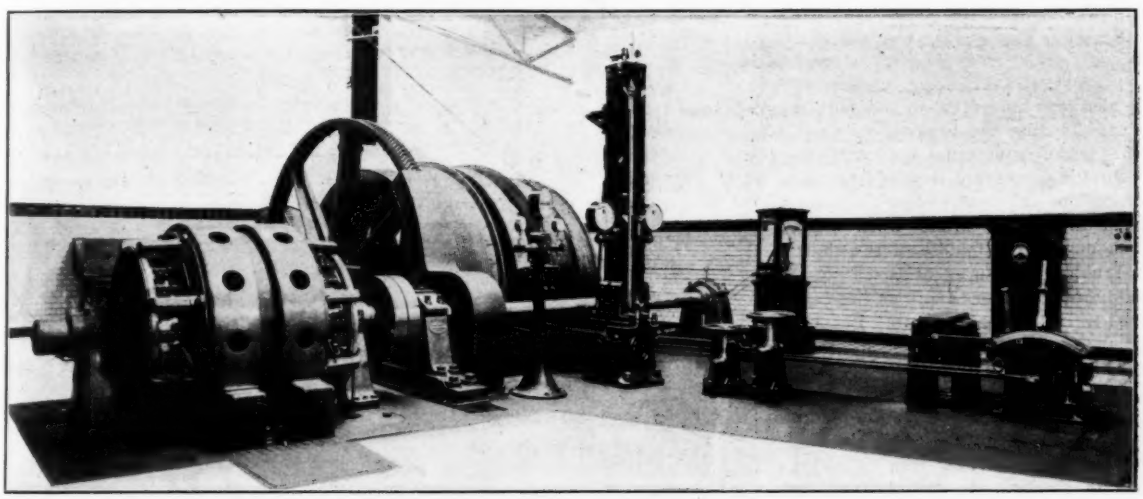


Fig. 2.—Cable Hoist in Czeladz Mine, Poland, Driven by Three-Phase Double-Commutator Motor.

The second method used for mining work consists in running the cable motor directly on a three-phase circuit, this being done by the use of an entirely new motor built on the Brown-Boveri-Deri system with double commutator, as shown in Fig. 3. On each commutator is a set of fixed brushes and a second set of movable brushes. The starting, speed regulations and reversing are done without using resistance, entirely by shifting the second set of brushes. This allows of braking and stopping the load without the need of a mechanical brake, and this feature of the motor is of great value for the design of a slowing-down device.

Fig. 2 shows the use of this method in the Czeladz mine in Russian Poland, and the small space taken up by the plant will be noticed. The use of the new motor makes an installation of this kind a very simple one, and reduces the amount of apparatus needed. The economic yield is excellent here, even when the mine has but little depth, on account of the absence of losses in starting, and this accounts for the favor which the new motor is having. In fact there are already about 30 of them that have been put in use within two years.

In connection with the two systems just mentioned, there have been designed some very useful devices for carrying out the operations in the best way. These are assembled as much as possible upon the device known as the operating lever set. This device has but a single lever which serves for operating and braking. It moves in two perpendicular planes, first on the main or long groove and second on a short cross groove placed at the middle of the sector casing. The longitudinal movement causes the variation of the field resistance of the dynamo in the Leonard system, or the shifting of the movable brushes in the double-commutator motors. Transverse movement of the lever works the brake. A locking electromagnet, worked by a relay, serves to check a too rapid movement of the lever which would overload the motor. Instead of the usual electromagnet for loosening the safety brake, there is used a small magnet fixed to the apparatus whose armature works against a spring. In usual running, when the armature is removed from the core mechanically by the lever's movement, or else is released by the magnet's action, the armature strikes the safety-brake-loosening device for throwing on this brake. This armature is brought back by a small lever, and this lever can also serve to work the safety-brake by removing the armature mechanically from its core.

The operating lever device is made on about the same plan for all cases. For the Leonard system the lever set and a switch for opening the field of the cable motor during stops are mounted on the device. This has a pressure regulator for the working brake and a three-way cock (with minimum pressure relay) for the safety brake in case of using compressed air. For the new double motor just mentioned, the lever also serves to work the main motor switch and thus to cut off the motor during stops. This switch, according to the power of the motor, is an ordinary switch mounted on the device or an oil switch in separate box (as seen in Fig. 4), and the switch also serves as safety circuit-breaker, being opened at the same moment that the safety brake operates. The switch cannot be closed before the armature is replaced on its core, that is, until the cause that has opened the circuit has disappeared. Besides, the main lever must have been brought to middle position, and this prevents cutting the current before the brushes have come upon the neutral line so that the motor exerts no couple. Both compressed-air or electric brakes can be used. The throwing on of the safety brake is assured in these two cases by the falling of a counterweight. The usual working brake, on the contrary, is operated as an air or electric brake.

As concerns the safety brake, it is of quite a new design. Former apparatus for avoiding shocks in the moving parts of the brake device acted so as to dampen the shock of the brake during the entire movement of the counterweight, thus causing a certain delay. The Brown-Boveri device allows the weight to fall freely until the exact moment when the brake shoes touch the rims, then a slowing

down effect is produced, so that only one-fifth second elapses between the release and the commencement of the braking, instead of two or three seconds as before. This allows less pressure for shoes and smaller rim diameter, also less movement of the cage in the shaft during the braking.

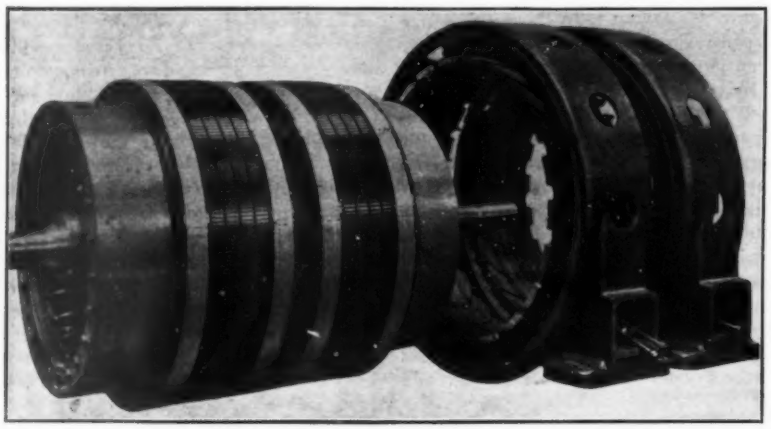


Fig. 3.—Rotor and Stator of Double-Commutator Three-Phase Motor, Brown-Boveri-Deri System.

The brake apparatus is made so that braking pressure depends on the position of the mine-level gauge. Should the safety brake work when the cage is at the middle of the shaft, the braking pressure increases more slowly, but it is more rapid as the cage comes near the shaft mouth. For use with pressure, this avoids accidents due to sudden braking. The counterweight of the safety brake is lifted by the use of a compressed-air piston device, in case compressed-air braking is employed. When the working brake is electric, the lift is done by hand or by the brake motor.

Of quite a new type is the electric motor braking device shown in Fig. 5. It has a synchronous three-phase motor and a threaded shaft carrying a nut which connects with the brake, also a friction clutch. When the brake is off, the motor runs idle at standard speed. Side movement of the lever throws on the clutch, driving the screw and nut and applying the brakes; then the clutch begins to slip, the amount of slip being regulated by the pressure on the halves of the clutch until the brake is fully thrown, when the motor gives its maximum torque and stops. On bringing the lever laterally to the end, this produces a locking of the brake in position and unclutches at the same time, so that the motor runs free. Thus the motor can be of small size. This gives a simple and economical device, using but little power, and in some ways it is superior to air braking.

The automatic slowing up and stopping of the cage at the end of its course is the object of careful attention. It is known that the Leonard system allows of obtaining a well determined speed for each position of the working lever, this speed being theoretically independent of the load. We thus have an automatic stop of the machine at the end of the course by simply bringing the lever to the rear. But in the case of variations of load and especially when the cage descends, the speed is different from regulated standard speed and may at times be quite high, for it is often required to provide the dynamo with compensating coils to prevent self-exciting. In the present system this is overcome by using a patented compensating winding for the dynamos which gives about constant speed independent of the load, either in lifting or descending.

Another improvement is a slowing-up device which allows of obtaining a relation between the load and the movement of the cage near the shaft mouth. Special compensating of the dynamo is achieved by the aid of a special exciter, the voltage regulation of the dynamo being made by varying the exciter voltage and not by using resistances. The exciter has two field windings, one in series with a rheostat and the second connected to a shunt placed on the main circuit connecting the dynamo and motor. The second field winding thus carries a current proportional to the main current, and such field is added to the first during the rise of the cage and is subtracted during the descent. Thus the speed of the hoisting motor corresponds to the position of the operating lever regardless of the amount of load.

A patented method of coupling adds to the effects of compounding in order to give a proper slowing of the machine. The slowing should commence sooner or later according to the amount of load or again on up or down movement of the cage. On the up movement, the load aids the braking, but works against the braking when on the descent, and this would produce bad results when the slowing devices are regulated for up-going

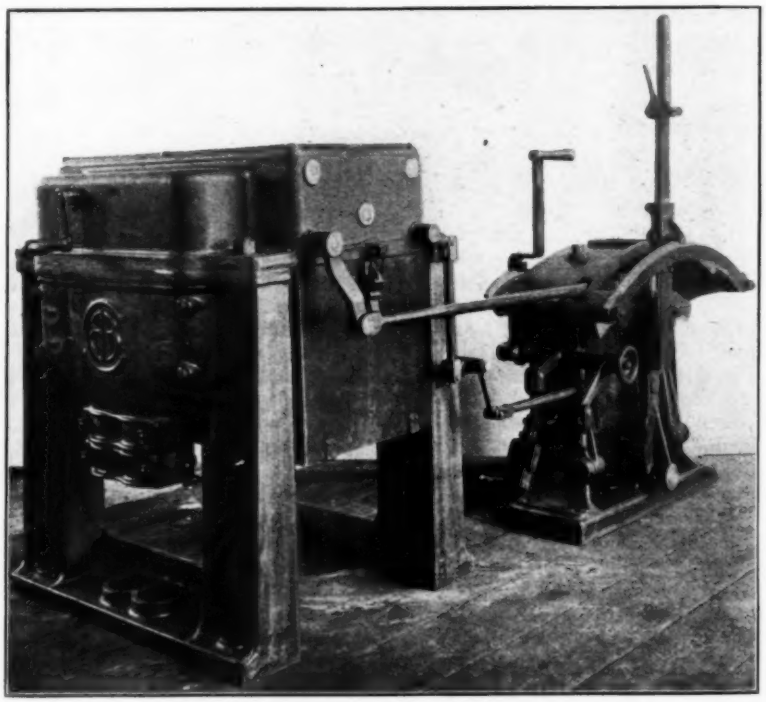


Fig. 4.—Control and Brake Gear with Oil Switch.

alone. All previous difficulties are avoided by the Brown-Boveri method, which consists in the use of an extra variable resistance in the field circuit of the dynamo; the resistance is normally short-circuited. When the cage comes to a certain point in its run, depending on the amount and direction of current in the hoisting motor and thus upon the net load, this extra resistance is put progressively in circuit. It is thus possible to regulate the distance covered by the cage during the slowing up, according to the amount of net load and the direction of movement. The distance can be reduced without danger of overload as much as is needed for a given load on the machine, and thus the machine is fully utilized and the device serves both for safety and economy.

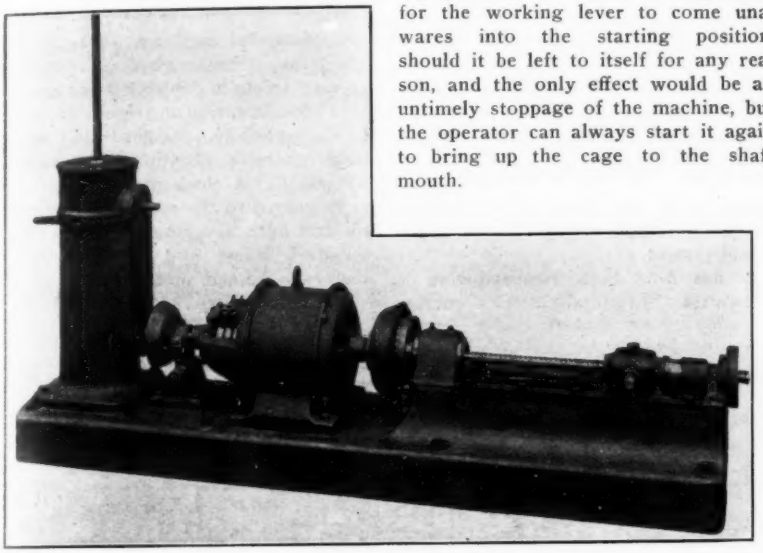


Fig. 5.—Electric Brake with Variable Pressure.

Such results are more difficult to obtain with the new three-phase double motors, for (on account of the series characteristic they possess) the speed varies with the load for any given position of the working lever. To realize an electric braking, it is required to shift the brushes to the other side of the neutral point. At first sight the fact that the motor has a series characteristic would seem to place it at a disadvantage in regard to the Leonard system. But in practice it is found that certain advantages are given by the form of the motor characteristic, as concerns the slowing up. During the run, the operator is able to give the machine the most favorable speed. Should this speed become too high through the operator's negligence, a contact acting by centrifugal force serves to throw the safety brake, and this stops the machine without shocks, as described above. At the end of the course, the working lever is brought to the extreme position for braking. The friction of the brushes on the commutator exerts a certain torque on the brush-holder ring, which tends to bring the working lever into the braking position. Thus it is impossible for the working lever to come unawares into the starting position, should it be left to itself for any reason, and the only effect would be an untimely stoppage of the machine, but the operator can always start it again to bring up the cage to the shaft mouth.

In closing, there may be mentioned some of the results obtained in practice with the Brown-Boveri methods. The cable machine in the Mauveschacht was put through official test by the Silesian administration and in this case the plant worked at only 75 per cent of its capacity and under unfavorable conditions for the steam turbine. But even here the steam consumption per net horsepower-hour was only 16.7 pounds, and it is claimed that no other system has given such good results. Other tests were made at the Rastenberg plant, and they are of interest as this machine is smaller than the above. Besides, the amount of three-phase current is less in this case, for the above plant was laid out for 1,000 kilowatts, while the present one figured but 200 kilowatts. Here the steam consumption is 17.1 pounds per horsepower-hour, and this figure is noteworthy, for the cable hoist was not fully utilized and on the other hand, the three-phase part of the equipment worked at but half load.

As regards the plant at the Czeladz mine with the new three-phase double motor, official tests have not as yet been made, but a series of wattmeter readings gave 1.4 kilowatts per net horsepower used in the cable lift, for 560-foot depth and the relatively high speed of 20 feet per second or 1,200 feet per minute.

Electric Tractor for Lumber and Saw Mills.

Considerable study has been given to improving the handling of lumber in large saw mills. The primitive methods usually employing mules have proven expensive. Not only is the feeding and care of many mules costly, but they produce much wear and tear on the tramway, necessitating frequent repairs. As the result of this study of the problem there has been developed an electrically operated tractor which has been in experimental use for a year at the plant of the Industrial Lumber Company, Elizabeth, La. Two of these machines are now in very successful daily operation at this plant and promise to revolutionize the haulage of lumber in plants of this kind.

These machines consist largely of parts of standard electric trucks, combined with special patented features, which make them suitable for use with any standard lumber buggy. The manufacturer claims they will do the work of from six to ten mules. Rubber tires protect the tramway, and the cost of upkeep, when compared with mules, is negligible. Storage batteries operate the tractor and it is so simple that any man of ordinary intelligence can operate it. By the use of this machine two men can now do the work which formerly required six to ten men.

The electric tractors are manufactured by Woodward, Wight & Company, Limited, New Orleans, La.

New Sizes of Ralco Plugs and Receptacles.

Since designing and placing on the market the first Ralco plug and receptacle, the Central Electric Company, Chicago, Ill., has seen the demand for this heavy-duty plug increase step by step. This demand may be largely attributed to the constant lowering in cost of current by central-station companies, for this makes economical the use of many electrical devices, whereas before the high cost of current practically prohibited their use.

New 30-Ampere Receptacle and Plug.

The illustration herewith is the new No. 8, 30-ampere Ralco plug and receptacle. Nos. 9 and 14 are similar to the one shown, except that No. 9 plug is for

60 amperes and No. 14 plug is for 100 amperes.

The Ralco heavy-duty plugs and receptacles have many uses. For instance, they are being used in shops for portable grinders, riveters, boring tools, forges, lathes, etc. In the home they are convenient for use in connecting up washing machines, vacuum cleaners, flatirons, heaters, etc. In the garage they may be used to great advantage as well as in hotels, churches, and other places where a reliable power outlet is desired. The rigidness of these receptacles and plugs provides for safety and low maintenance.

Rico Coasting-Time Recorders for Electric Cars and Trains.

The Rico coasting-time recorder is an instrument that records the actual number of minutes that an electric car or train is operated without the use of power or brakes. It is an efficient and desirable device to secure greater economy in operating railway equipments.

It reads in "coasting minutes," delivering a printed voucher-slip to the motorman at the end of each run. This voucher-slip shows the degree of economy which the motorman has exercised on every run. By a system of ranking or rewards, the railroad company may make a practical and monetary inducement to the men for economical operation, and thus greatly reduce the amount of current ordinarily used in the propulsion of electric cars. Its purpose is to make a motorman substitute brains for sheer muscle.

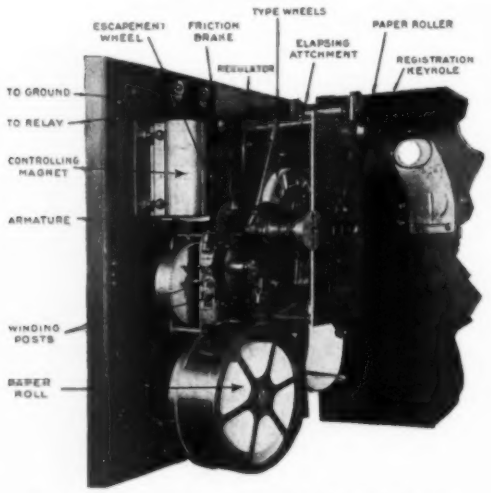


Fig. 2.—Rico Coasting-Time Recorder Mechanism.

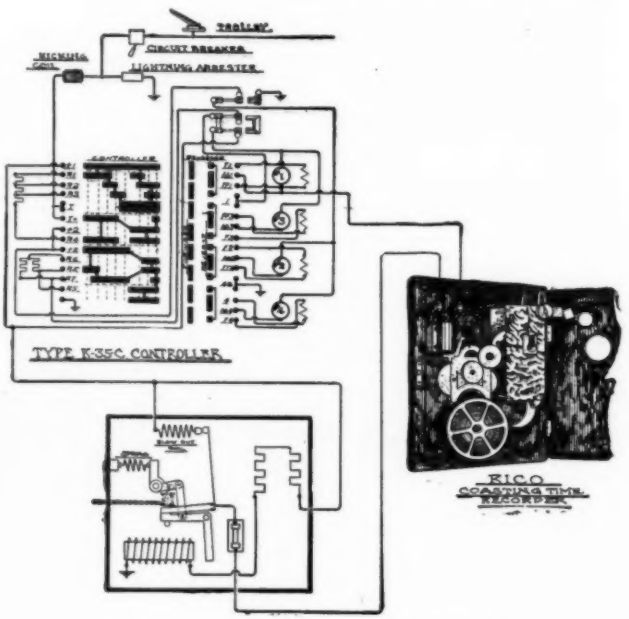


Fig. 2.—Wiring Diagram of Coasting Recorder.

This device provides an accurate and consistent means of obtaining a record of the amount of coasting secured in the operation of electric railway equipments. The energy input to a car is utilized to overcome the resistor losses in starting, to overcome the losses in the motors and wiring, to impart velocity to the car, and to overcome friction. By far the larger part of the energy for a service with frequent stops is that required to impart velocity to the car. The momentum thus imparted will keep the car in motion without additional energy if the power is shut off and the car allowed to coast to a complete standstill. Although coasting to a standstill is not practicable for the accomplishment of reasonable schedule service, improvement in economy of current consumption can be effected by the nearest permissible approach to the above condition. The greater the amount of coasting on any given schedule, the less total energy expended for its accomplishment.

It has long been admitted that a large part of the total electrical energy is wasted daily on nearly every railroad in the country through the variable handling of cars by motormen, and it is remarkable that this great loss has continued for years without steps having been taken to correct it. The Rico coasting-time recorder has proven in service that it effectively eliminates most of this loss.

The coasting recorder is a simple and reliable automatic device which effectively puts an automatic and impartial check upon each man at all times. Its object and method of operation are readily understood by the motorman, who soon becomes not only alert in its use but enthusiastic in the support of operation which is increasing his efficiency and actually his earning power. The recorder is an efficient guide for the motorman to operate properly and provides a continuous check on his operation for each trip.

The coasting recorder consists of a recording mechanism as shown in Fig. 1 and an electric relay. One recorder and one relay are necessary for each car or each multiple-unit train. The recording mechanism consists of a specially designed recording instrument somewhat similar to those in use for factory time-keeping. The printing mechanism is controlled and driven by a double-spring marine-movement clock, especially designed to withstand excessive vibration and weather changes. This clock movement is directly geared to the recording mechanism and both are mounted on a solid cast-steel frame and inclosed in a steel case. Each motorman is given a registration key bearing his badge number. With this key he registers at the beginning and end of the trip.

An examination of the wiring diagram, Fig. 2, shows that the current can reach the controlling magnet on the clock movement only when the traction motors are running as generators; the back electromotive force or generated voltage of the motors when coasting furnishes energy for the clock magnet. The magnet and brake attachment is so arranged that it can be adjusted to meet any operating condition.

The electric relay is so arranged that when the controller is "on" no current can possibly get through to the clock magnet from the traction motors. When the brakes are applied the clock circuit is opened. Consequently a motorman must have the car

moving without power or brakes on in order to get current into the magnet that operates the clock.

With this type of relay it is impossible for a motorman to coast to a standstill and obtain a fictitious record, as the energy which operates the clock magnet ceases when the motor stops.

The relay is inclosed in a substantial steel case, and locked or sealed as desired. On straight air-brake cars the relay is installed at any convenient place, but where hand brakes are used exclusively the relay is installed under the car.

These instruments are being marketed by the Westinghouse Electric & Manufacturing Company for use with equipments of its manufacture.

Producer Gas from Wood Waste.

Plants in which all kinds of wood waste, from sawdust to pieces six inches in diameter, as well as cotton seeds, cocoanut shells, coffee husks and many other kinds of refuse, can be used for the manufacture of producer gas are now being manufactured in England, according to a paper presented before the Junior Institution of Engineers in that country by G. E. Lygo. In designing a plant for this purpose many changes must be made from the coal producer. The surface area required is determined by the nature of the fuel used and its size, but will average 2.5 times that required with coal. The depth of the fuel bed will depend upon the size and density of the fuel. A deep bed is necessary where the pieces are large; whereas a shallow bed is preferable with small fuel like sawdust. A vaporizer is not required.

The gas must be cooled and washed immediately upon leaving the generator or else the heavy tar in suspension is deposited and will choke the piping.

The calorific value of wood when air-dried is approximately 6,000 British thermal units per pound. The amount consumed in generating a horsepower-hour depends upon the moisture, which varies from 10 to 20 per cent in air-dried wood to 30 or 50 per cent in fresh wood. Fuel containing an excess of moisture must be dried until it is reduced at least to 60 per cent. The gas produced from wood waste has a higher calorific value than that from anthracite coal, namely, 150 to 170 British thermal units per cubic foot as against 120 to 140 from coal. A test made with a Whitfield producer supplying an 84-horsepower engine direct-connected to a generator showed 540 kilowatt-hours for 2,072 pounds of fuel consumed or 3.83 pounds of fuel per kilowatt-hour. This test extended over 10 hours and the fuel consisted of sawdust and chips.

Largest Electric Hoist in America to be Installed in Montana.

The directors of the North Butte Mining Company in a recent meeting at Duluth, Minn., voted to award to the Westinghouse Electric & Manufacturing Company the contract for what will be the largest electric hoist in the two American continents and one of the largest of its kind in the world.

The hoisting drums, which will be 12 feet in diameter, will be driven by a direct-connected electric motor running at a speed of about 71 revolutions per minute. Power will be supplied to this motor from a motor-generator set equipped with a 50-ton flywheel to secure elimination of the peaks that would be drawn from the power line during period of starting and acceleration.

Hoisting with this equipment will be done in balance, but the equipment is large enough to take care of unbalanced hoisting. Skips will be used for handling the ore and each skip will have a capacity of seven tons. Round rope 1.625 inches in diameter will be used and the equipment is designed for a normal rope speed of 2,700 feet per minute with a maximum of 3,000 feet per minute.

This hoist will be installed on the new Granite Mountain shaft which at present is rapidly approaching the 2,900-foot level. The capacity of the hoist will permit 300 tons per hour being hoisted from the 2,000-foot level or 200 tons per hour from the 4,000-foot level.

The system of control and power equalization used will be that commonly known as the Ilgner system, in which a flywheel driven by the motor-generator set is permitted to give up some of its stored energy to supply the peak load drawn by the hoisting motor. In order to reduce the flywheel losses to a minimum, the flywheel will be incased in a smoothly finished steel housing and provided with special self-lubricating bearings.

A number of special safety devices are included in the equipment, including electrically released brakes; automatic slowdown devices to prevent the skip or cage ever going through head sheaves and a special controller to limit the speed when hoisting men.

The hoisting motor will be of the type used in steel mills and will be of very heavy construction. In fact, all of the equipment has been designed with absolute reliability as the paramount consideration. The electrical equipment alone will weigh in excess of 250 tons.

The hoist motor will have a maximum intermittent rating of 4,500 horsepower and the motor-generator set will be driven by an induction motor having a continuous normal rating of 1,400 horsepower. The difference between these ratings represents approximately the amount of energy that will be supplied by the flywheel momentarily during starting. The installation is so designed that the draft of power from the power line will be practically constant throughout any cycle of hoisting.

Some very high economies have been guaranteed on this installation by the manufacturer and this installation will be watched with interest particularly with a view of comparing its economy with that of the pneumoelectric hoisting system designed by Bruno Hordberg, that is being used at ten of the Anaconda mines.

This Granite Mountain hoist of the North Butte Mining Company will be the largest electric hoist anywhere in the western hemisphere and will be one of the largest using the Ilgner system of power equalization installed anywhere in the world. There are larger electric hoists in South Africa, a few of which use the Ilgner system of power equalization, but most of these South African hoists do not attempt to obtain power equalization.

A Substitute for Cement.

U. S. Consul W. W. Masterson of Harput, Turkey, states in a recent report that in that country, where cement is not used or hardly known, a substitute has been found that has met with rather good results when applied in exposed places, in filling crevices in water pipes, covering joints in stone floors, in fountains, and for numerous other purposes where cement would be required. The mixture is as satisfactory in water as in exposed places, but it must be allowed to become thoroughly dry before it is submerged.

The mixture is slaked lime, linseed oil, and cotton fiber. Generally a hollowed-out stone is used, although a flat, hard surface will answer, and the process is started by pouring the oil on a handful of cotton, after which the lime is dusted in. It is then kneaded until the whole is thoroughly mixed and about the consistency of dough. The more it is kneaded the better it becomes.

This compound has undergone a severe endurance test at the Harput consulate. Two years ago the stone floor in the balcony on the north side of the house leaked in several places and rotted the woodwork supporting the balcony. The floor was finally taken up, new timber added, and the stone flags again put down. Between each stone this mixture was forced in and smoothed over the joints. It took several days for hardening, the oil spread out on the stones for about half an inch from each joint, leaving a slight mark, but the compound soon hardened like cement, and today the surface over the part where the stones are joined is as hard and smooth and water-tight as if cement had been used.

An Electrostatic Oscillograph.

An electrostatic oscillograph suitable for recording very high voltages was described by H. Ho and S. Koto in a paper presented at a meeting of the Physical Society of London on October 24. Two vertical bronze strips pass symmetrically between the parallel metallic field plates. The lower ends are connected by a silk fiber which passes under an ivory pulley. An extremeley small mirror is attached to the strips. This arrangement constitutes the vibrator, which is mounted upon an ebonite frame and immersed in an oil bath. The strips are connected to a direct source of about 300 volts.

The alternating voltage to be recorded is connected to the field plates, in parallel with which there are two condensers in series. The electrical midpoint of the direct-current battery is connected to a point between the condensers. The turning moment on the strips is proportional to the product of the momentary values of the alternating voltage and the direct voltage, so that if the latter is constant, the deflection of the mirror accurately follows the variation of the former. Oil plays an important part, not only acting as a damping agent and insulator, but increasing the sensitiveness on account of its high dielectric constant.

In cases where voltage is low, but the source of energy is so limited that a sufficient current cannot be taken to actuate the ordinary oscillograph, the electrostatic vibrator may be used by applying the voltage in question to the strips, while the terminals of a high-tension battery, or influence machine, are connected to the field plates. The instrument may also be used for recording very small currents by replacing the condensers by two equal resistances, which are traversed by the current.

With the natural period of vibration adjusted to 0.003 second, 2,800 volts gave a deflection of one centimeter at a radius of 70 centimeters.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

HEATERS, Electric.—Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Curling-iron heater, Bulletin No. 460, 110-125 volts, 55 watts; with special flush wall cabinet.

Standard for installation only in such walls of fireproof buildings as contain no combustible materials.

Approved November 24, 1913.

LAMP CLUSTERS.—Chapman & Walker, submittors, 118-120 Richmond Street, West, Toronto, Can.; manufactured for the above by Sterling Telephone & Electric Company, Limited, 212 Tottenham Court Road, London, Eng.

"O. K." wireless clusters, porcelain bases and removable porcelain rings, metal shells. Not over 250 volts.

Multiple types; two-lamp type, catalog No. A-476; three-lamp type, catalog No. A-477.

Approved November 17, 1913.

MISCELLANEOUS—The T. W. Manufacturing Company, 571 West Van Buren Street, Chicago, Ill.

"Cross-Lox" Universal Bushing.

Approved October 14, 1913.

RHEOSTATS.—S. J. Stewart, 312-314 Carondelet Street, New Orleans, La.

3 to 5 horsepower, 250 volts.

This starter, for alternating-current motors, consists of wire-wound resistance coils inclosed in a case. A three-pole double knife switch with an extra set of contact clips on one side and extensions for inclosed fuses at the other, is mounted on a slate base. Springs are provided to prevent the switch being left in the running position.

Approved October 15, 1913.

SWITCHES, Oil-Break.—Trio Manufacturing Comany, 2424 Third Avenue, Rock Island, Ill.

Oil switch for starting alternating-current motors. Two and three-phase, 30 amperes, 600 volts.

This device is an oil switch provided with an inclosed fuse compartment and so designed that the fuses are inaccessible when the handle is in the running position. The circuit is not broken in passing from the starting to the running position.

Standards for the construction and test of oil switches of both the manually operated or non-automatic type and the automatically operated or circuit-breaker type are under consideration. Pending the establishment of such standards, the results of examination of construction details and reports of satisfactory performance in the field indicate that the 600-volt alternating-current oil switches and circuit-breakers made by this manufacturer are suitable for use.

Approved November 17, 1913.

SWITCH BOXES, Supports for.—Flush Plate & Appliance Company, Incorporated, 738 Security Mutual Building, Binghamton, N. Y.

"On-Quik" supporting plate.

A rectangular plate with lugs to be secured under the screws which hold the supporting lugs for switch boxes. The plate entirely surrounds the face of the box and has holes through which the supporting screws pass, the standard cover plate entirely covering the supporting plate.

Approved November 3, 1913.

SWITCHES, Knife.—Fort Wayne Electric Works of General Electric Company, Fort Wayne, Ind.

Interconnected switch and Lunkenheimer valve for control of motor-operated pumps for water supply.

1, 2, 3 and 4-pole, 30 amperes and 60 amperes, 250 volts, one-half and three-quarter-inch valves.

These devices are rated standard as being in compliance with requirements of the National Electrical Code. This rating is to be understood as indicating that in their construction the electrical fire hazard has been reduced to an acceptable degree. It is not to be construed as an approval of the devices for use in connection with automatic-sprinkler or similar fire-protective equipments, for which service their merits have not been investigated.

Approved November 14, 1913.

WIRES, Slow-Burning Weatherproof.—Imperial Wire & Cable Company, Limited, Montreal, Can.

White slow-burning insulation on the outside.

Tag on coil to read: "Nat'l Elec. Code Standard."

Approved November 14, 1913.

SIGN MACHINES.—Phelps Manufacturing Company, 265-269 Jefferson Avenue, Detroit, Mich.

Thermostatic flashers, each consisting of carbon contactors carried on steel springs and mounted in a cast-iron box having a pipe extension containing the thermal element.

Type J, 2 to 25 amperes, 125 volts.

Single-circuit, catalog Nos. 111, 113, 115, 117, 119, 153-55 inclusive.

Double-circuit, catalog Nos. 112, 114, 116, 118, 120, 150-52, inclusive.

Approved November 17, 1913.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

HOOPPOLE, ILL.—Papendick and Tankinson will install an electric-lighting system here.

BLOOMING PRAIRIE, MINN.—An agitation has been started here for electric lighting. C.

MILAN, MINN.—A movement is on foot for the establishment of an electric light plant here. C.

BARRE, ILL.—A municipal light plant may be established here. Address the city clerk.

OAK PARK, MINN.—Leon C. Wiley will install a plant and furnish the village with light. C.

TAGUS, N. D.—Ira D. Bush will put in an electric light plant and furnish lights for the village. C.

VIRGINIA, MINN.—Improvements to the electric light plant and system will be made to cost $3,600. C.

SIBLEY, IOWA.—A municipal lighting plant will be established here. Address the mayor in regard thereto.

PHOENIX, ARIZ.—$25,000 will be expended improving the street lighting. Address the city clerk for particulars.

KEWANEE, ILL.—Estimates will be secured for electric and gas plants. Address Mayor Baker for particulars.

THREE FORKS, MONT.—Cluster lights will be installed on the business street. Write to the president of the Council for desired information. C.

BESSEMER, MICH.—Bonds will be voted on the village of Wakefield for $5,000 to purchase electrical equipment.

BERTHA, MINN.—The council is considering giving the Bottemiller Company a franchise for electric lights.

SHERIDAN, WYO. — Sheridan County Electric Company will install cluster lights on the business streets.

BUTTE, MONT.—The Butte Protective Company will place its wires underground. Address the secretary for desired data.

BLAIR, NEB.—Plans have been prepared for the construction of an electric light plant by The Towle Engineering Company of Omaha, Neb.

MIDDLETOWN, N. J.—The Middlesex & Monmouth Electric Light, Heat & Power Company will install an electric lighting system here. A.

BEAVER DAM, KY.—Bonds have been voted for the construction of an electric light plant here. Address the mayor in regard to the matter.

LISBON, N. D.—The Lisbon Electric Light & Power Company has been organized with a capital of $30,000 by Frank B. Thompson and others. C.

LASALLE, ILL.—Public utilities companies here have been given 90 days by the city to start work placing their wires underground in the business district.

SOUTH SIOUX CITY, IOWA.—The Council is planning ways and means to secure electric lighting. Address Mayor W. A. Morgan for information.

GALVA, ILL.—The Galva Electric Light Company has purchased a site for the erection of a new power plant. E. O. Brown, of Elmwood, is interested. Z.

LAMOURE, N. D.—The LaMoure Light & Power Company has been incorporated with a capital of $24,000 by M. A. Erickson, T. A. Curtiss and others. C.

PHILADELPHIA, PA.—The Fairmount Park Power & Light Company has been incorporated under the laws of Pennsylvania with a capital of $1,000,000.

TACOMA, WASH.—The city is planning to install an ornamental lighting system for a distance of 30 blocks. Address B. W. Colins, superintendent of Electrical Works.

KENDALLVILLE, IND.—The Public Utilities Committee has directed Clerk Meyers to advertise for bids for an improved ornamental boulevard-lighting system here.

FALL CREEK, WIS.—The village of Fall Creek will build and operate a municipal electric light and power plant here. Address the village clerk in regard to the matter.

CAPE GIRARDEAU, MO.—The Missouri Public Utilities Company, St. Louis, will improve and extend the electric light, power and water systems here at a cost of $100,000.

GREENFIELD, MASS.—The Board of Trade is considering making recommendations for improvements in the street lighting of the town, with special reference to Main Street.

FREMONT, MICH.—The citizens of this place are forming a stock company to supply the town with electric current for lighting purposes. Address the town clerk for further particulars.

INTERNATIONAL FALLS, MINN.—A municipal water and light plant is being considered for this place. Write L. W. Wilson, president of the Council, or W. V. Kane, mayor. C.

CLARA CITY, MINN.—The Commercial Club has taken up the proposition of electric lighting and M. S. Carl and E. Thien have been appointed to investigate the matter. C.

GREGORY, S. D.—The Gregory electric light plant here was destroyed by fire. The loss on machinery and building was $12,000. Address city clerk for further information.

ARKADELPHIA, ARK. — Outside capitalists have arranged to purchase the Arkadelphia Water & Electric Company, and the new owners plan to spend $15,000 on improvements.

CLINTONVILLE, WIS.—The Common Council has voted to purchase a 20-horsepower steam or oil engine for the municipal water and electric light plant. Address the city clerk for information.

GLIDDEN, WIS.—The Glidden Light, Power & Water Company, Incorporated, has been incorporated and capitalized at $5,000 by Fred Boheim, Conrad Mohr, Frankie Deringer, Leopold Gibit and Julius Schroeder.

KERKHOVEN, MINN.—The council has made an agreement with the Kerkhoven Roller Mill Company whereby the latter will install an electric light and power plant and furnish the city with lights. C.

BRUNING, NEB.—Plans are being prepared for the construction of an electric light plant and water works system. Bids will be received January 15. The cost is estimated at $16,000. Address J. J. Breckert, clerk.

LITTLE ROCK, ARK.—A charter has been granted to the Crittenden Power Company, Earle, $20,000 capital. John F. Rhodes is president; H. A. Harrison, vice-president and treasurer; and J. B. McMillan, secretary.

BIG STONE, S. D.—A stock company composed of leading local business men and other residents has been formed to install and operate an electric lighting system. Address M. A. Benjamin for information.

ANACONDA, MONT.—The Mountain Power Company has the contract to install ornamental lighting in the business district. The contract calls for the completion of the work and the turning on of the lights by July 1, 1914.

SPRING VALLEY, MINN.—The Southern Minnesota Power Company is planning to erect a 13,000-volt transmission line to Grand Meadow, a distance of about 10 miles. Address M. C. Brown, superintendent, for desired information.

SAUK CENTER, MINN. — The Commercial Club will urge the Council to have a "White Way" lighting system installed on the business streets. Messrs. Hilsdale and Hillerud have been appointed a committee to take the matter up. C.

SPRINGFIELD, MASS.—The City Council asks for bids for electrical work on the addition to the Buckingham School. A check for $500 must accompany each proposal. B. Hammett Seabury, 21 Besse Place, Springfield, has specifications for the work. W.

PORTLAND, IOWA. — Central Iowa Light & Power Company has been incorporated to construct, maintain and operate power plants for the supply and distribution of electricity for all purposes. The capital is $300,000. A. F. Jones is president of the company.

ESTERVILLE, IOWA.—The Commercial Club is considering the development of a hydroelectric project in this vicinity. A favorable report has been

made by R. H. Wickham, the hydraulic engineer who investigated the conditions. About 200 horsepower can be developed under a low head.

PERTH AMBOY, N. J.—Residents of Market Street, headed by Joseph B. Quick, 141 Market Street, have submitted a proposition to the Board of Aldermen for an ornamental lighting system on such thoroughfare. Tentative plans call for the installation of ornamental iron standards, about 200 feet apart. A.

ANAHEIM, CAL.—The Anaheim Board of Trade is discussing the proposition of lighting the state highway from Fullerton to Santa Ana, a distance of 11 miles. The associated Chambers of Commerce of Orange County has been asked to appoint a committee to further the project. Address the city engineer for particulars.

BOISE, IDAHO.—Further electric development on the Malad River is under way and a second large plant, which will generate 15,000 horsepower, will be built early next year by the Idaho Power & Light Company, formerly the Beaver River Company, at a point just above the dam which diverts the water for the plant already in operation there. E. P. Bacon is general manager of the company.

CARROLLTON, ALA.—At a recent meeting of the City Council a franchise was granted the Delma Lumber Company, composed of George M. Collins and Dr. H. H. Mobley of Gordo, for the purpose of operating and maintaining an electric light plant for the next 20 years. The promoters of this enterprise expect to begin at once constructing their power house and it is understood will be rushed to completion.

EUGENE ORE.—Announcement of plans for immediate development of a $5,000,000 power project at Clear Lake in the headwaters of the McKenzie, 90 miles from Eugene, by the Oregon Electric, and the construction of two hydroelectric plants to develop over 45,000 horsepower, have been announced by George S. Edmonstone, hydraulic engineer of the Oregon Electric Railroad. Construction on the first of the two units will commence in June, or as soon as the snow leaves, and the work rushed. Permanent camps will be established and arrangements made to continue construction throughout the entire 12 months of the year. To complete the entire project will require four or five years, but the first plant will be completed in less than half of that time.

PITTSBURGH, PA.—Brilliant illumination by thousands of electric lamps will be tried by the South Pittsburgh Board of Trade as a medium to boost business. The South Side merchants have come to realize that they have fallen behind the North Side and the East End districts in the matter of stimulating trade, both of these districts having installed a system of street lighting and window illuminations that have made the streets attractive after dark. Now the merchants of the South Side will do the same with Carson Street, for a distance of nearly three miles. Attractive building signs of electric bulbs and appropriate window lighting will add to the glare that is to transform one of the oldest thoroughfares of the city into a veritable "Great White Way."

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

STANLEY, N. D.—The Fairview Farmers Telephone Company has been incorporated with a capital of $25,000.

MILO, MO.—The Monticello & Milo citizens are organizing a telephone company. Address McKoy Brothers Lumber Company for information.

BETHANY, MO.—The Mutual Telephone Company has been incorporated with a capital stock of $50,000 by John A. Lilly, W. M. Foster and others.

ROCKFORD, ILL.—The Home Telephone Company contemplates the installation of a new semi-automatic switchboard in its new building to be erected. Z.

ST. ELMO, ILL.—The Fayette Home Telephone Company has been incorporated with a capital stock of $20,000 by Hattie M. Stice, Earl F. Stice, J. A. Stiles and others.

PICNIC, SASK.—Tenders are wanted for the construction of a rural telephone system by Victor Rooke, secretary-treasurer of The Graham-Chatsworth Rural Telephone Company. C.

PALISADE, MINN.—The Palisade Rural Telephone Company has been incorporated for $5,000 by H. E. Hansel, William J. Weber, Thomas Thompson, J. H. Tolvstad, Lydia Hansel, Dr. J. O. Werntz and H. E. Meyers, all residents of Palisade.

MURPHYSBORO, ILL.—Contemplated improvements have resulted in a call for a special meeting December 11 of the stockholders of the Murphysboro Telephone Company to consider an increase in capital stock from $50,000 to $250,000. Z.

HENRY, W. VA.—Clay Telephone Company has been incorporated to operate a telephone line. The capital stock is $5,000 and the incorporators are B. C. Eakle, P. M. Summers, James Reed, A. T. Copenhaver, R. A. Hamrick, H. M. Young and others, all of Clay, W. Va.

PITTSBURGH, PA.—The stockholders of the Central District Telephone Company have voted to increase the capital stock of the company from $15,000,000 to $25,000,000. It has also been decided to issue $25,000,000 worth of bonds to provide for extensions in this section.

DAYVILLE, ORE.—The John Day Valley Telephone Company has been organized with a capital of $5,000 for the purpose of buying out the Sunset Telephone Company's line from Canyon City to Dayville and the Spray Telephone Company's line from Dayville to Mitchell. C.

PENDLETON, ORE.—Extensive improvements to the local telephone system, including the placing of Pendleton on the main toll line and the placing of all wires in the city in cables are to be made in the near future by the Pacific Telephone & Telegraph Company. O. C. Brill, district plant manager of Portland, may be addressed.

JERSEY CITY, N. J.—The Board of City Commissioners has made the following appropriations for equipment items for the Department of Public Safety: three Penn registers for Telegraph Department, $1,125; three take-up reeds, $75; one marble monitor, $240; removal of overhead lines on Grove Street, $325; three 20-ohm relays, $60. A.

JACKSON, MICH.—Vice-president T. C. Powell, of the Cincinnati, New Orleans & Texas Pacific Railway, is credited with the statement that a telephone line will be immediately constructed between Oakdale and Chattanooga, Tennessee, a distance of 84 miles, upon the completion of which the telephone will be used for dispatching trains on the entire line between Cincinnati and Chattanooga.

SCRANTON, PA.—Every passenger train on the Delaware, Lackawanna & Western Railroad is to be equipped with wireless apparatus if certain tests on the two limited trains are successful. It is intended to introduce the wireless system over the entire distance between Hoboken and Buffalo. The plan is to have the stations about 50 miles apart. The power of the wireless stations is sufficient, however, to send messages many hundred miles.

CARBONDALE, PA.—Edward M. Friske of Hazleton, general manager for the rehabilitation of the Consolidated Telephone Companies of Pennsylvania; C. J. Larson of Hazleton, chief engineer, and James Stewart, the local division manager, held a conference in this city, at which extensive improvements and increased facilities were decided upon. The improvements will cost between $15,000 and $20,000, and will be begun immediately.

ELECTRIC RAILWAYS.

(Special Correspondence.)

TRENTON, N. J.—The Public Service Railway Company has been granted a franchise for the construction and operation of a line to connect its present lines in Adeline and Liberty Streets.

MIDDLESBORO, KY.—J. L. Marning, mayor, is interested in the construction of a street railway system here. Dr. J. Godfrey Hunter has been mentioned in connection with the same project. G.

NASHVILLE, TENN.—Col. J. W. Tilford will construct two electric lines, one from Nashville to Adairville, Ky., and one from Springfield Tenn., to Franklin, Ky. The lines will cross at Arlinda, Tenn. G.

HARRISBURG, PA.—B. C. Hovis, F. J. Taylor, W. H. Larimer, W. B. Crawford and A. L. Davies have made application for a Pennsylvania charter for the Western Traction Company, to operate electric railways in this state.

WARDNER, IDAHO.—Prominent mining men and business men of this city contemplate the construction of an electric interurban between this city and Kellogg, to be used for the transportation of both passengers and ore from the mines near Wardner.

PORTLAND, ME.—Fort Dodge, Des Moines & Southern Railroad Company has been organized for the purpose of locating, constructing and maintaining street railways, with $2,000,000 capital stock. Albert F. Jones is president, and T. L. Croteau, of Portland, treasurer.

LOUISVILLE, KY.—Asked to encourage the plan to build an electric interurban line from Louisville to French Lick Springs by way of New Albany, the Board of Directors of the Board of Trade referred the matter to a special committee composed of Alfred Pranels, E. H. Bowen, Jacob Zinsmeister and James F. Buckner, who will make an early report.

HERRIN, ILL.—The construction of the proposed electric interurban railroad from Harrisburg to Herrin seems assured. W. H. Schott, head of the Schott Traction System, which is completing an electric line from Carrier Mills to Eldorado, may be addressed in regard to the project.

FORT WORTH, TEX.—It is stated by the promoters of the Fort Worth-Denton interurban that the route of the proposed line is to be selected shortly and construction work started in January. About $500,000 has been subscribed for the road. William Capps, of Fort Worth, is interested in this project. D.

ST. JOHNS, N. B.—Plans for the construction of an electric railway across northern Maine are reported. The road is known as the Allegash extension of the Quebec Railway Company and is 110 miles in length, extending from St. Johns, N. B., northwestward. The Allegash section is estimated to cost more than $2,500,000. It is proposed to continue the road ultimately to Quebec. W.

CLARKSTON, WASH.—A movement to construct between three and four miles of street car line to serve Clarkston and Vineland, was launched recently by enthusiastic citizens of this city. A company will be incorporated for $25,000, and shares will be sold for $25 each. Former Mayor R. M. Yount, M. Huylete, cashier of the Clarkston State Bank, and other important men of this city, are identified with the movement. O.

BROOKSVILLE, FLA. — The Brooksville Interurban Railway Company has been organized with a capital of $100,000, the object of which is to construct trolley lines to Lake Stafford. The first construction will require about 16 miles of track, with Brooksville in the geographical center, but the promoters plan to secure a charter that will put at least 30,000 acres of land within a mile and a half of a trolley line and increase the capital to $500,000.

PORTLAND, ORE.—The franchise granting to the Portland & Oregon City Electric Railway Company the right to operate cars over certain streets of this city passed the City Council recently by a unanimous vote. By the terms of the franchise the company must begin work inside the city within sixty days. According to M. G. Munley, representing the company, actual construction work of grading and laying the track will start immediately. O.

FORT MYERS, FLA.—Rumors of the building of an interurban line across the peninsula from Fort Myers on the Gulf coast to Palm Beach on the Atlantic coast are revived by the Fort Myers *Press*, which interviewed E. Prouty, one of the noted inventors and promoters of today, at the close of a week's reconnoitering trip from Lake Okeechobee to Fort Myers. Mr. Prouty gave out little information relating to the object of his visit to that part of the state, but it is understood from a reliable source that he will build an interurban railroad to connect Fort Myers with the East Coast at Palm Beach. The first section is to be to Lake Okeechobee, and until the second section is laid the finest passenger boats that float will complete the connection with the interurban line.

NEW INCORPORATIONS.

WINSTON SALEM, N. C.—North Carolina Service Company has been incorporated with a capital stock of $50,000 to establish an electric plant.

BOSTON, MASS.—Shawmut Electrical Signal Company has been incorporated with a capital of $300,000 by J. B. Clogher, J. M. West and E. L. Parsons, Boston.

NYACK, N. Y.—Dubelier Electric Company, Incorporated, has been granted articles of incorporation by William Dubelier, William Kleinberg and Embury McLean, all of New York City.

NEW YORK, N. Y.—United Gas & Electric Engineering Corporation has been incorporated with a capitalization of $100,000. The incorporators are William H. Clark, Henry Morgan and George H. Olney, all of this city.

BROOKFIELD, N. Y.—The Brookfield Electric Light & Power Company, Incorporated, has been granted articles of incorporation with a capitalization of $2,500. The incorporators are William Welch, Charles H. Brown and Edgar Harris, all of this place.

NEW YORK, N. Y.—Weber Supply Company has been incorporated to deal in electrical supplies and appliances. The capital stock is $6,000 and the incorporators are William Smart and May Smart, and Frederick W. Weber, New York City.

CHICAGO, ILL.—The Ingersoll Electric Vaporizer Company has been incorporated with a capital stock of $15,000 to manufacture and sell machinery tools, devices, etc. The incorporators are Homer H. Ingersoll, Theobold Mueller and Daniel Mueller.

CHICAGO, ILL.—Ionex Electrical Development Company has been incorporated with a capitalization of $2,500 to manufacture and deal in electrical and mechanical machines, etc. The incorporators are Luther Johns, Irving S. Kemp and Edgar F. Beabein.

GENEVA, N. Y.—Hammer-Beach Electric Company, Incorporated, has been granted articles of incorporation to enter the electrical contracting field. The capital stock is $10,000 and the incorporators are Arthur R. Page, Leo L. Hammer and Henry C. Palmer.

CHICAGO, ILL.—The Tyrone Electric Company has been incorporated with a capital stock of $100,000 by A. A. Rolf, Alvin E. Stein and others to manufacture and sell electric current for light, heat and power. Address A. E. Stein, 1838 South St. Louis Avenue, Chicago, for further information.

CHICAGO, ILL. — The Swedish Rhythmic Vibrator Company has been incorporated with a capital stock of $10,000 to manufacture, assemble and deal in electric vibrators and other electric and mechanical appliances. The incorporators are Blake O. Smith, C. E. Barry and William A. McGuire.

CUMBERLAND, ME.—Articles of incorporation have been filed by the Northwest Company, having a capitalization of $200,000. The company is given the right to buy and develop water power, operate electric roads, etc. The directors of the company are Albert T. Jones, T. L. Croteau, Albert A. Richards, B. M. Maxwell, A. B. Farnham, Clarence C. Trott and J. P. O'Donnell, all of Portland.

FINANCIAL NOTES.

Arrangements are being made by the Pacific Gas & Electric Company for the sale of $500,000 one-year six-per-cent notes to local bankers. This is a part of an authorized issue of $7,000,000, of which $4,500,00 were sold a short time ago.

The National Gas, Electric Light & Power Company has filed a certificate of increase of its capital stock from $4,000,000 to $10,000,000. The stock is divided into $5,000,000 six-per-cent preferred and $5,000,000 common.

At the annual meeting of the New York Railways Company a resolution was adopted authorizing an increase in the membership of the board of directors from nine to eleven. The two additional members, who will be elected later, will probably be T. DeWitt Cuyler and John C. Cobb, of Boston. The retiring directors were re-elected.

Stockholders of the Edison Company of Boston voted to issue 22,756 new shares of stock, thus increasing its capital from $18,204,400 to $20,480,000. The right for stockholders to subscribe to the new stock will end on December 30, and the shareholders of record may subscribe for the new issue at $215 a share at the rate of one share of new for each eight shares of present stock.

The board of directors of the Columbus Railway & Light Company has called two assessments of $10 a share each on the $5,000,000 capital stock of the company. The first assessment is to be paid on or before December 30, 1913, and the second is to be paid on or before June 30, 1914. The stock is now $20 a share paid up. After assessments are paid, stock will be exchanged for stock of the Columbus Railway, Light & Power, under which the companies now operated by the Columbus Railway & Light will be consolidated.

Arrangements have been made through Ladenburg, Thalmann & Company and E. H. Rollins & Sons of New York City for the extension of $1,800,000 first-mortgage six-per-cent bonds of the Market Street Cable Company, which mature December 15, 1913, to December 15, 1915. All financial details connected with the extension of the bonds have been fully carried out. The Market Street Cable Company is one of the underlying companies of the United Railroad of San Francisco. The bonds form part of an issue of $3,000,000, of which $1,200,000 were paid on maturity on January 1, 1913.

At the special meeting of the stockholders of the Washington Water Power Company, held at Spokane, the proposition of the board of directors to increase the capital stock of the company from $15,000,000 to $20,000,000 was favorably voted on by more than two-thirds of the stockholders present. Stockholders will have a right to subscribe to shares at par, equal to 10 per cent of their holdings. For the present, stock will be issued in amounts sufficient to take care of some outstanding notes which were made incident to the construction of the $3,000,000 power house, and for future construction work.

Permission to execute a $20,000,000 trust deed and to issue bonds to that amount has been granted by the New York Public Service Commission to the Empire United Railways, Inc., the holding company of the Rochester, Syracuse & Eastern and other electric railways owned by the Beebe syndicate. The entire issue will not be put out at once.

The new mortgage will be known as a first and refunding mortgage, and will cover future issues put out for extensions and construction. Bonds will be issued to the par value of $9,617,000 at once, the major portion of which will be used in the retirement of obligations of the Rochester, Syracuse & Eastern, the Syracuse, Lake Shore & Northern and the Auburn & Northern Railways. Of this amount $5,000,000 will be used for the retirement, by purchase, exchange or refund of an equal amount of the 40-year five-per-cent first-mortgage bonds the Rochester, Syracuse & Eastern, Company, while the remainder will be used to retire other obligations, including the three-year six-per-cent notes of the Rochester, Syracuse & Eastern.

Dividends.

American Gas & Electric Company, regular quarterly of 1.5 per cent on the preferred and two per cent on the common stocks, the preferred payable February 1 to stock of record January 21 and the common, January 2 to stock of record December 20. Also regular quarterly of two per cent on the common, payable April 1 to stock of record March 21.

Augusta, Aiken Railway & Electric Corporation: regular quarterly dividend on preferred of 1.5 per cent, payable December 31 to stockholders of record December 15.

Brazilian Traction, Light & Power Company, Ltd.: quarterly of 1.5 per cent on the preferred stock, payable January 2 to stock of record December 15.

Canadian General Electric Company: quarterly of 1.75 and one per cent extra, payable January 2 to stock of record December 15.

Central States Electric Corporation: regular quarterly of 1.75 per cent on the preferred stock, payable December 31 to stock of record December 10.

Duluth Superior Traction Company: the regular quarterly dividends of one per cent on the common and one per cent on the preferred stock, payable January 2 to stock of record December 18.

El Paso Electric Company: semi-annual preferred dividend of $3 per share and quarterly common dividend of $2 per share, the former payable January 12 to stock of record January 3, and the latter December 15 to stock of record December 6.

Indianapolis Street Railway Company: semi-annual dividend of three per cent, payable January 1 to stock of record December 22.

Interborough Rapid Transit Company: regular quarterly of 2.5 per cent, payable December 19 to stock and voting trust certificates of record that day.

Manhattan Railway Company: the regular quarterly dividend of 1.75 per cent payable January 1 to stock of record December 15.

Manila Electric Railroad & Lighting Corporation: declared the regular quarterly dividend of 1.75 per cent on the preferred stock, payable December 31 to stock of record December 17.

Montana Power Company: the regular quarterly dividends of 1.75 per cent on the preferred, and 0.5 per cent on the common stocks, payable January 2 to stock of record December 15.

Montreal Power Company: quarterly of 1.75 per cent on the preferred stock and 1.5 per cent on the common, payable January 2 to stock of record December 15.

New York State Railways: the regular quarterly dividends of 1.25 per cent on the prefered stock and 1.5 per cent on the common, payable January 2 to stockholders of record December 18.

St. Joseph Railway Light, Heat & Power Company: quarterly of 1.25 per cent on the prefered stock, payable December 31 to stock of record December 15.

Twin City Rapid Transit Company: regular quarterly dividend of 1.5 per cent on the common and 1.75 per cent on the preferred stocks, payable January 2 to stock of record December 17.

United Traction Company of Philadelphia: semi-annual of three per cent, payable January 1 to stock of record December 10.

Virginia Railway & Power Company: a regular semi-annual dividend of 2.5 per cent on the preferred stock, payable January 21 to stock of record December 24.

West End Street Railway: quarterly of $2 on the preferred stock, payable January 1 to stock of record December 24.

Western Electric Company: quarterly of $2 and $2 extra, payable December 31 to stock of record December 24.

Reports of Earnings.

CONSUMERS POWER COMPANY OF MICHIGAN.

	October.	12 Months.
Gross earnings	$ 276,665	$3,087,164
Net after taxes	145,313	1,645,683
Surplus after charges	57,665	700,712
Balance after preferred dividends	30,165	392,212

COMMONWEALTH POWER, RAILWAY & LIGHT.

October gross	$ 249,887	$ 128,362
Expenses, taxes and interest	66,230	19,908
Preferred dividends	80,000	30,000
Balance	103,656	78,453
Twelve months' gross	2,070,705	1,266,762
Expenses, taxes and interest	391,134	126,227
Preferred dividends	660,000	360,000
Balance	1,019,571	780,534

SOUTHERN CALIFORNIA EDISON.

	1913	1912
October gross	$ 414,092	$ 366,934
Net after taxes	209,335	148,918
Surplus after charges	133,749	87,643
Depreciation	65,000	40,000
Balance	68,749	47,643
Ten months' gross	3,939,112	3,547,867
Net after taxes	1,980,258	1,635,329
Surplus after charges	1,275,685	1,036,987
Depreciation	570,000	485,000
Balance	705,685	551,987

PUGET SOUND TRACTION, LIGHT & POWER.

	1913	1912
September gross	$ 717,282	$684,220
Net after taxes	312,228	298,661
Surplus after charges	137,854	130,616
Twelve months' gross	8,477,119	.....
Net after taxes	3,547,142	.....
Surplus after charges	1,495,798	.....

REPUBLIC RAILWAY & LIGHT.

	1913.	1912.
October gross	$ 257,126	$ 230,773
Net after taxes	100,664	93,102
Surplus after charges.	56,859	49,232
Twelve months' gross.	2,962,319	2,606,841
Net after taxes	1,161,928	1,039,435
Surplus after charges.	624,817	509,007

FEDERAL LIGHT & TRACTION.

	1913.	1912.
September gross	$ 168,752	$ 178,417
Net	52,621	79,695
October gross	194,206	184,087
Net	73,765	79,963
Ten months' gross	1,909,848	1,745,741
Net	783,303	730,642

KEYSTONE TELEPHONE.

	1913.	1912.
October gross	$ 106,335	$ 103,798
Net after taxes	51,226	51,150
Surplus after charges.	25,358	25,894
Ten months' gross	1,050,752	1,005,616
Net after taxes	516,338	498,699
Surplus after charges.	261,504	247,144

PACIFIC GAS & ELECTRIC.

	1913.	1912.
October gross	$1,315,227	$1,186,351
Net	527,560	416,497
Other income	42,185	28,956
Total income	569,745	445,453

NORTHERN CALIFORNIA POWER.

	1913.	1912.
October gross	$ 79,223	$ 71,516
Net after taxes	53,655	37,145
Surplus after charges.	24,468	9,039

PHILADELPHIA COMPANY.

	1913.	1912.
October gross	$2,048,508	$1,778,695
Net	690,117	605,501
Seven months' gross	13,909,760	12,137,498
Net	5,003,873	4,350,088

AMERICAN LIGHT & TRACTION COMPANY.

	1913.	1912.
October gross	$ 416,830	$ 398,100
Net earnings	407,223	388,728
Ten months' gross	3,529	3,370,748
Net earnings	3,426,985	3,272,579
Twelve months' gross.	4,415,595	4,221,457
Net earnings	4,293,433	4,104,104

MONONGAHELA VALLEY TRACTION.

	1913.	1912.
October gross	$ 87,393	$ 77,837
Net	53,506	48,248
Surplus after charges.	27,707	23,510
Ten months' gross	788,831	705,450
Net	508,679	425,111
Surplus after charges	262,587	213,555

BRAZIL RAILWAY.

	1913.	1912.
September gross	£ 256,860	£ 206,030
Net	101,000	79,071
Nine months' gross	2,072,334	1,906,535
Net	749,400	824,282

MASSACHUSETTS LIGHTING COMPANIES.

	1913.	1912.
October net sales	$ 93,629	$ 87,738
Four months' net sales	344,589	324,124

TWIN CITY LINES.

	1913.	1912.
October gross	$ 765,160	$ 696,066
Net	390,004	357,203
Surplus after charges.	241,411	214,124
Ten months' gross	7,333,922	6,785,137
Net	3,622,548	3,336,365
Surplus after charges.	2,151,109	1,908,574

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Dec. 8.	Dec. 1.
American Tel. & Tel. (New York)	119½	120⅜
Commonwealth Edison (Chicago)	127¾	128
Edison Electric Illuminating (Boston)	261	261
Electric Storage Battery common (Philadelphia)	46¾	47
Electric Storage Battery preferred (Philadelphia)	46¾	47
General Electric (New York)	139	136½
Kings County Electric (New York)	119	119
Manhattan Transit (New York)	1¼	1⅛
Massachusetts Electric common (Boston)	10½	10½
Massachusetts Electric preferred (Boston)	66	64½
National Carbon common (Chicago)	130	130
National Carbon preferred (Chicago)	110	112
New England Telephone (Boston)	133½	133½
Philadelphia Electric (Philadelphia)	25⅞	22½
Postal Telegraph and Cables common (New York)	79	77¼
Postal Telegraph and Cables preferred (New York)	65½	64
Western Union (New York)	62	62½
Westinghouse common (New York)	65¼	63⅞
Westinghouse preferred (New York)	112	112

PERSONAL MENTION.

MR. PERCY S. YOUNG, comptroller of the Public Service Gas Company, Newark, N. J., was elected president of the National Commercial Gas Association at its ninth annual convention at Philadelphia, Pa., December 2 to 6.

MR. R. A. HUEY has been appointed manager of the Van Buren plant of the Fort Smith Light & Traction Company, Fort Smith, Ark. He succeeds MR. W. A. BRENT, who has for some time been manager of the Van Buren office.

VICTOR C. TOUSLEY, chief electrical inspector of the city of Chicago, made an interesting address on "Electrical Inspection" before the Armour Institute of Technology Branch, American Institute of Electrical Engineers, on the evening of December 9.

MR. E. B. ROWE, chief illuminating engineer of the Holophane Works of the General Electric Company, Cleveland, Ohio, presented a paper on lighting topics before the members of the Cornell Section of the American Institute of Electrical Engineers at their regular meeting on December 12. The subject announced is "The Influence of Science on the Art of Illumination."

MR. H. D. FITCH, of Bowling Green, Ky., has been made general manager of the Kentucky Public Service Company, which owns and operates the lighting plants in Bowling Green, Hopkinsville, Owensboro and Frankfort, Ky. The same company operates gas plants for heating purposes in several of these towns. Mr. Fitch has been manager of the Bowling Green property for some time. The headquarters of the company will be established in that city, which is one of the most important in Southern Kentucky.

MR. GEORGE WESTINGHOUSE was awarded the Grashof Medal, the highest honor in the gift of the German Society of Mechanical Engineers, at the meeting of the American Society of Mechanical Engineers at New York City on December 3. Mr. Westinghouse was unable to be present and the medal was accepted on his behalf by MR. JAMES HARTNESS, newly elected president of the American Society of Mechanical Engineers. The auditorium was filled to its capacity with a distinguished audience, including many representatives of the German Society of Mechanical Engineers. Following the presentation of the medal, MR. JOHN W. LIEB, vice-president of the New York Edison Company, delivered an address on Leonardo Da Vinci, engineer and architect.

MR. HOWARD G. WILSON, traveling electrical engineer of the insurance firm of Fred S. James & Company (Chicago), has accepted the position of editor with the Underwriters' Laboratories, Inc. Mr. Wilson was a student at Armour Institute, entering practical work in 1900 in electrical department of the ship yards at South Chicago. Later he became connected with the Western Fire Appliance Company, and leaving this firm he entered the services of the Commonwealth Edison Company in the operating department. Later he accepted a position with the Iroquois Iron Company. This was followed by work with the Illinois Steel Company in the electrical construction and operating departments. In 1909 Mr. Wilson became connected with the Chicago Board of Fire Underwriters, as electrical inspector, and after three years in this work, entered the employ of Fred S. James & Company, which position he leaves to accept the position of editor with the Laboratories. Mr. Wilson has from time to time contributed articles on various subjects allied to electricity and insurance engineering, to technical periodicals in this field.

MR. HUGH H. HARRISON has been elected president of the Merchants Heat & Light Company, Indianapolis, Ind. Mr. Harrison is well known financially, being vice-president of the Ann Arbor Railroad Company, a director of the Empire Trust Company of New York City, and a director of the Colorado Power Company. He is largely interested in a number of other enterprises and has for the last 14 years been engaged in organizing and financing companies of this character. He is also interested in street railway companies in New Jersey, and it was largely through Mr. Harrison's efforts that the Imperial Electric Light Company of St. Louis, the Scranton Electric Light Company of New Jersey, the Lackawanna Electric Light Company and the Baltimore Electric Light Company were organized and financed.

OBITUARY.

MR. ROBERT E. BINNING, an electrical expert, died on Saturday, December 6, at his home in Plainfield, N. J., aged 50 years. He was at work at Lima, Peru, on the construction of a light and power plant when he was stricken ten months ago with an illness from which he never recovered.

MR. C. E. DELAFIELD, district manager of the Intermountain territory of the Crocker-Wheeler Company, died on November 30 in Denver, Colo. Mr. Delafield was associated for a number of years with the Wagner Electric Manufacturing Company, of St. Louis, Mo., and was later sales manager of the Ohio Brass Company, of Mansfield, O. He entered the service of the Crocker-Wheeler Company on September 1, 1909, and had recently filled the position of district manager of that company's Intermountain territory with headquarters at Denver and Salt Lake City.

MR. CHARLES S. SMITH president and general manager of the Smith Webbing Company, of Pawtucket, R. I., died on December 2, as a result of being struck by an automobile. Mr. Smith was born in Waterbury, Conn., July 21, 1867. He was educated in the New Haven High School, and when 16 years old entered the factories of the Winchester Arms Company, learning the trade of machinist. When he was 21 years of age he entered the employ of the Thomson-Houston Electric Company as an electrician. It was during his early years that the inventive genius made itself manifest in his work, and during his life he took out many patents, principally on webbing machinery and loom attachments. Mr. Smith was working for the Thomson-Houston Company in 1889, in Rio De Janeiro, when the overthrow of Emperor Don Pedro came about. After the revolution he took a trip around the world and upon returning entered the employ of the American Mills Company, makers of elastic webbing. About 15 years ago he established the Smith Webbing Company at Woodlawn, of which he was president, treasurer and general manager at the time of his death. He also organized the Chernack Manufacturing Company and the Tubular Woven Fabric Company of Pawtucket, and was an officer in both concerns.

NEW PUBLICATIONS.

KANSAS FUELS.—Engineering Bulletin No. 3 of the University of Kansas is entitled "Kansas Fuels: Coal, Oil and Gas." It discusses the supply and constituents of these fuels and describes investigations to determine the heating value and composition. This work has been performed by P. F. Walker and Walter Bohnstengel.

PROPOSALS.

ELECTRICAL APPLIANCES.—Sealed proposals will be received until December 23, by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing miscellaneous dental electric engines, etc., and seven dental electric sterilizers, to be delivered at the Navy Yard, Brooklyn, N. Y., as per Schedule 6,091.

WIRE CABLE.—Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until December 26 for furnishing wire cable, as per Canal Circular 812, copies of which may be obtained from the Purchasing Officers located in all of the larger cities of the United States.

ELECTRICAL WIRE.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until December 23 for furnishing 11,000 feet of plain, 10-conductor interior-communication cable; 10,000 feet of galvanized, soft-steel, leaded and armored, twin-conductor wire; and 6,000 feet of plain twin-conductor wire, to be delivered at the Navy Yard, Brooklyn, N. Y., as per Schedule 6,089.

ELECTRICAL EQUIPMENT.—Bids will be received on January 30 by the Sewerage and Water Board, Room 508 City Hall Annex, New Orleans, La., for four 600-horsepower synchronous motors; seven 1,200-horsepower synchronous motors; one 1,200-horsepower induction motor; eleven 50-kilowatt motor generators; 11 motor-driven rotary vacuum pumps; nine switchboards; six 1,200-kilovolt-ampere transformers; three 750-kilovolt-ampere transformers; one 450-kilovolt-ampere transformer; one 150-kilowatt rotary converter auxiliary apparatus, consisting of starting compensators, small transformers, electrolytic lightning arresters, etc. Address F. S. Shields.

DATES AHEAD.

American Association for the Advancement of Science. Annual meeting, Atlanta, Ga., December 29-January 2, 1914.

National Independent Telephone Association. Annual convention, Chicago, Ill., January 13-15, 1914.

Northwestern Cedarmen's Association. Annual convention, January 6, 1914.

South Dakota Independent Telephone Association, Sioux Falls, S. D., January 14-15, 1914.

Wisconsin Electrical Association. Annual convention, Milwaukee, Wis., January 15-16, 1914.

Western Association of Electrical Inspectors. Annual meeting, Cincinnati, O., January 27, 1914.

With the Electrical Manufacturers

The Wilson-Maltman Electric Company, Baltimore, will begin the manufacture of panelboards, switchboards and knife switches. The company will also carry on a business as contractor and dealer.

Chicago Fuse Manufacturing Company, Chicago, announces that Walter O. Roach, one of its traveling sales representatives, will hereafter call on the trade in Chicago and vicinity formerly handled by William E. Finlay, who has tendered his resignation. This charge will be effected December 15.

The Ideal Electric & Manufacturing Company, Mansfield, O., announces the reopening of its Chicago office at Room 1116 Fisher Building. J. A. Adamson, who has had a number of years' experience in the sale of electrical machinery in the Chicago territory, will be in charge of the office as district manager.

The Diamond Elecric Supply Company, Incorporated, Peoria, Ill., has succeeded to the Mills Electric Company, known for the last eight years to the electrical trade of the Central West. There is no other change in the corporation, the officers and directors remaining the same. H. M. Butler is president, J. D. Butler secretary and treasurer, and T. W. Endsley sales manager.

Faries Manufacturing Company, Decatur, Ill., has just published catalog No. 29. This is one of the most complete publications relating to patented adjustable electric brackets, portables and shades, gas-electric combination fixtures and fittings that has been available in many a day. The arrangement of the various products is such that finding a fixture to meet any particular requirement is made easy and the material is so grouped and classified that the catalog may be used with the greatest facility.

Mississippi Wire Glass Company, New York, N. Y., has issued a 58-page attractively illustrated book devoted to its product and showing many large and handsome structures in which its wire glass is extensively used. A historical sketch of the manufacture of wire glass is given, together with data on the various types of glass made, information of value in glazing, a discussion of the efficiency of wire glass windows, etc. Smaller illustrations show nearly 20 samples of the various types of wire glass manufactured by the company.

W. J. Jeandron, 171 Fulton Street, New York, N. Y., has prepared some very interesting literature relating to carbon brushes and commutator troubles. Mr. Jeandron has compiled the results of many tests and experiments, and engineers of electric light and power stations particularly, and electricians in charge of motor-driven equipment are finding a great usefulness for the information that Mr. Jeandron has available. Mr. Jeandron is the importer of Le Carbone brushes, and will be pleased to send to those interested, full information respecting this material.

The Electric Storage Battery Company, Philadelphia, Pa., on December 1, in celebration of its twenty-fifth anniversary, entertained representatives of the various electric vehicle manufacturers. A luncheon was given at the factory at noon, followed in the afternoon by an inspection of the various departments of the works, and an automobile trip and reception at the home of Mr. Herbert Lloyd, president of the company. In the evening a banquet with cabaret was given the guests at the Ritz-Carlton Hotel. Durthe week of December 1, a sales convention was held by the company at the Bellevue-Stratford Hotel, the managers of the various sales offices being in attendance.

Pass & Seymour, Incorporated, Solvay Station, Syracuse, N. Y., has published bulletin No. 829, describing and illustrating handy electrical wiring devices. While the company does not claim infallability, it is of the opinion that P. & S. handy electrical wiring devices are made as nearly trouble-proof as it is humanly possible for them to be. When trouble does occur with any P. & S. material the company will correct it without red tape or mental reservation. A number of new articles not shown previously are presented in bulletin 829. In addition to a comprehensive description of the devices, together with trade numbers and complete shipping and buying information, there is a well worked-up illustration showing the application of each device. Copies of this catalog will be furnished to those interested upon request.

The Lumley-Denly Company, Ashtabula, O., has been incorporated to take over the business of the **Ashtabula Manufacturing Company.** The new company will continue to manufacture a full line of hardware specialties, including Hubbard's patent metal base knobs, floor stops, shelf brackets, door bolts, etc., heretofore made by the old concern, and will also manufacture a line of electrical specialties. Wilfrid Lumley, for several years chief engineer of the Tungstolier Works of the General Electric Company, is president and general manager of the company and will have charge of the factory, which is located at Ashtabula. Charles T. Denly, who was connected with the firm of Austin & Denly, is secretary of the company and will have charge of sales, with offices at 419 Frankfort Avenue, Cleveland.

Flour City Ornamental Iron Works, Minneapolis, Minn., announces that owing to the large increase in its business during the past year it has been decided to increase the working capital of the company. At a recent stockholders' meeting an increase in the common stock was authorized to $1,000,000 and the issue of preferred stock up to $500,000 was ordered; most of this has been sold outright. This change brings in $350,000 additional capitalization and enables the company to increase its manufacturing facilities and service to its customers. A number of men of means and influence have joined the company, thereby making it possible to take on the largest contracts without taxing the resources or capacity of the organization. The officers and directors elected are as follows: Eugene Tetzlaff, president; William Burns and E. P. Wells, vice-presidents; Ernest Rubbert, secretary; Eugene Tetzlaff, Ernest Rubbert, E. P. Wells, F. G. Winston, S. W. Wells, William Burns, Jacob Stoft, L. E. Wakefield and A. A. McRae, directors.

Engineering Department, National Lamp Works of General Electric Company, Cleveland, O., has recently published a comprehensive bulletin on industrial lighting. This 64-page bulletin, which is No. 20, deals with the different factors that must be given consideration in the design and operation of an industrial lighting installation. The effects of voltage conditions on the operation of lighting units are clearly explained. Curves showing the performance of incandescent lamps in actual practice are given. Different types of reflectors are discussed at length along with their distribution curves. The effect of accumulation of dust on reflectors of different types is illustrated graphically. The principles of illumination design and the method of figuring operating cost are clearly outlined. The application of modern methods of illuminating engineering is shown by a number of illustrated descriptions of typical installations with complete data on each. The information is authoritative and given in a concise and direct manner that will appeal to readers. Copies of the bulletin may be secured by addressing the Engineering Department.

H. W. Johns-Manville Company announces that its Cleveland, O., branch has recently been obliged to provide larger quarters for several of its subsidiary offices. The Columbus office and contract department are now located on the ground floor of the new seven-story fireproof Peters Power Building, 45 West Long Street, with large warehouse facilities half a block distant. The Toledo office and warehouse have been moved to 213 Water Street. This office has just completed a pipe-covering, stack-lining and cork-tiling job in the Second National Bank Building, Toledo, which possesses many unique features. Other Cleveland branch sub-offices are located in Akron (717 Second National Bank Building), Dayton (259 Fourth Street Arcade), and Youngstown (502 Stambaugh Build-

ing). Resident representatives are stationed at Lima, Masillon, Greenville and other points in Ohio, also at Huntington and Parkersburg, W. Va. Their work is supplemented by a large corps of traveling men. The Cleveland branch has just closed a long-term lease for another larger warehouse on Front Street which, when remodeled, will give the branch larger and better storage and shipping facilities than ever.

Record of Electrical Patents.

Issued by the United States Patent Office, December 2, 1913.

1,079,931. Microphone. J. J. Comer, assignor to Automatic Enunciator Co., Chicago, Ill. A differential microphone transmitter.

1,079,935. Humidifier. C. S. Drake, Milwaukee, Wis. Includes an electric fan.

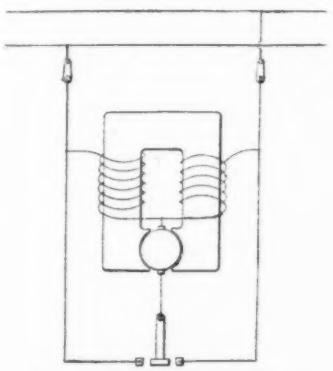
1,079,946. Trolley Finder. P. J. Minck, Brooklyn, N. Y. Has spiral finder drums on each side of the wheel.

1,079,948. Fuse Plug. T. E. Murray, New York, N. Y. A separable Edison plug.

1,079,997. Electrically Controlled Railway-Switch. E. S. Olmsted, assignor to Cheatham Electric Switching Device Co., Louisville, Ky. Includes two line contactors adjacent to each trolley wire, a relay and switch-operating device.

1,079,994. Commutator Motor. H. K. Schrage, assignor to Allmänna Svenska Elektriska Aktiebolaget, Vesteras, Sweden. The rotor has a primary winding and a regulating winding, the latter connected to a commutator on which bear two adjustable brushes connected to each separate phase of the stator.

1,080,005. Electric Water-Purifier. L. A. Fitzer, Los Angeles, Cal. The water passes between a series of alternate electrode plates arranged like those of an electric condenser.



1,080,026.—Motor-Reversing Means.

1,080,018. Electrical Communicating System. L. W. Miller, assignor to National Police Signal Co., Buffalo, N. Y. A telephone system with auxiliary time-recording machanism.

1,080,026. Motor-Reversing Means. H. B. Taylor, assignor to Westinghouse Electric & Mfg. Co. One armature terminal is connected to the middle of the field circuit and the other terminal to the other side of line. (See cut.)

1,080,028. Typewriting Machine. C. H. Vogel, assignor to Underwood Typewriter Co., New York, N. Y. Electromagnetic control for the type bar.

1,080,029. Electric Generating, Transmitting, and Distributing System. F. W. Walker, Port Washington, Wis. Has internal-combustion engines for driving rotary converters to help carry peak loads.

1,080,032. Locomotive Bearing. J. E. Webster, assignor to Westinghouse Electric & Mfg. Co. A special journal box for an electric locomotive.

1,080,044. Electrically Operated Reversing Gear. K. Brüll, Budapest, Austria-Hungary. The motor drives a pair of grab-controlling drums through a beveled pinion and either one of a pair of clutched beveled gears.

1,080,051. Electric Locomotive. G. M. Eaton, assignor to Westinghouse Electric & Mfg. Co. Structural side frames are arranged to permit ready removal of all of the wheel axles.

1,080,058. Switch. G. W. Hart, assignor to Hart Mfg. Co., Hartford, Conn. Has a special spring and plunger arrangement for the switch arm.

1,080,061. Induction Motor. R. E. Hellmund, assignor to Westinghouse Electric & Mfg. Co. Has a switching device embodied in the rotor for changing the number of rotor poles.

1,080,087. Automatic Signaling and Train-Stopping Device. C. C. Turner, Portland, Oreg., assignor of one-half to G. Yale. Track-circuit-controlled cab-signaling and motor-driven brake-applying system.

1,080,088. Automatic Signaling and Train Stopping Combination Circuit Device. C. C. Turner, assignor of one-half to G. Yale. Includes track batteries and relays connected to sectionalized signal rails.

1,080,089. Spark Plug. F. J. Walker and F. C. Loeffler, Des Moines, Iowa. Has an auxiliary grounding electrode.

1,080,091. Construction of Power Looms. J. Wintermayr, Vienna, Austria-Hungary. A solenoid holds the brake inoperative until shunted.

1,080,092 and 1,080,093. Chandelier. W. Adams, San Francisco, Cal. The first patent provides for reversible fixture arms for giving either direct or indirect lighting. The second patent provides for the same thing in a single unit with reversible reflector held in a ring with four supporting arms. (See cut.)

1,080,110. Changeable Headlight. V. Howard and J. P. Wrigley, Oakland, Cal. Switches associated with the steering mechanism close the circuit to one or another of the angularly placed side lamps.

1,080,113. Heating Molten Electrolytes. F. von Kügelgen, and G. C. Seward, assignors to Virginia Laboratory Co., New York, N. Y. An electrolytic cell has an auxiliary gas heater.

1,080,126. Controller for Electric Motors. H. F. Stratton, assignor to Electric Controller & Mfg. Co., Cleveland, O. The controller for the rotor resistance has an arm-retaining and release magnet connected across one of the primary phases.

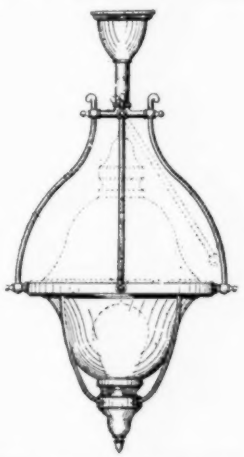
1,08,130. Cable Hanger. J. J. Walsh, Yonkers, N. Y. Comprises a sheet-metal saddle seated on the messenger wire and a sheet-metal split ring with hooked ends adapted to pass through slots in the saddle.

1,080,140. Motor-Control System. C. S. Dauler, assignor to Electric Controller & Mfg. Co. Includes solenoid resistance switches and a bypass for the first one of them.

1,080,146. Motor-Control System. J. H. Hall, assignor to Electric Controller & Mfg. Co. A traveling crane has separate motors and controllers for cross travel and hoisting, the latter providing for reversing and dynamic braking.

1,080,161. Indicator Mechanism. E. J. Pace and O. E. Kellum, assignors to National Street & Station Indicator Co., Los Angeles, Cal. Electromagnetically operated.

1,080,167. Means for Electrically Transmitting Orders or Signals and for Indicating Their Nature and the Points of Transmission. H. Quertier, Wellington, New Zealand. Includes a group of transmission-indicators connected to one side of the circuit and a group of message-indicators each connected to the other side of the circuit.



1,080,093.—Fixture for Direct or Indirect Lighting.

1,080,200. Alternating - Current-Motor Controller. C. A. Dresser and H. Fankboner, assignors to G. A. Edward Kohler, Chicago, Ill. Solenoid-controlled resistance-varying plunger.

1,080,214. Regulator for Electric Fluid-Heaters. W. S. Hadaway, Jr., New York, N. Y. A counterbalance and float arrangement to maintain a constant level of water in the heater.

1,080,230. Electrical Sliding Contact. J. V. Purssell, Friendship Heights, Md. Comprises a rebent spring body arranged to form a slideway for a slider rod; a contact carried by the body has insulated fingers secured to the ends of the body.

1,080,234. Dry-Cell Battery. A.

Rordame, Salt Lake City, Utah. The packing is composed of coarse-mesh cotton-netting cylindrical screens, whose interstices are filled with energizing paste, a porous lining within the inner one of the screens and battery mix between the central electrode and the porous lining.

1,080,236 and 1,080,237. Weighing Scale. J. L. Saylor, Minneapolis, Minn. A scale moves under a series of hoppers with electromagnetically controlled valves.

1,080,246. Controlling System for Signaling Circuits. C. E. Beach and H. W. Doughty, assignors to G. O. Knapp, New York, N. Y. An alarm system with a three-arm gang switch for each signaling circuit.

1,080,251. Means for Detaching Obstructions from Electric, Telephone, and Other Cable Conduits. M. Blumenthal, Brooklyn, N. Y. A detachable link for jar rods comprises a sleeve and rod with piston head, the two parts being coupled together.

1,080,257. Insulator. K. Bruchsaler, San Francisco, Cal. An insulating tube with conical head.

1,080,260. Intercommunicating Telephone System. P. G. Burgess, Jamaica, N. Y., assignor to General Acoustic Co. Provides for connecting local telephone stations through busbars to dictograph stations.

1,080,265. Means for Synchronizing Talking Machines and Moving-Picture Machines. H. T. Crapo, New York, N. Y., assignor to Webb Talking Pictures Co. Each machine is motor-driven through a mutually controlled circuit.

1,080,271. Art of Signaling by Electromagnetic Waves. R. A. Fessenden, assignor to S. M. Kintner, Pittsburgh, Pa., and H. M. Barrett, Bloomfield, N. J. The method of tuning two inductively coupled circuits by varying both the coupling and the amount of wire in each coil of the transformer by infinitesimal increments.

1,080,287. Signaling Device. M. Levison, assignor to Chicago Signal Co., Chicago, Ill. An electric annunciator system.

1,080,321. Printing Machine. G. M. Breckenridge, Chicago, Ill., assignor of one-third to J. P. McManus. Driven by an electric motor through an automatic clutch.

1,080,323. Automatic Fire-Alarm. L. J. Bryant and J. Case, Bradford, Pa. A fusible part holds the circuit open.

1,080,325 to 1,080,327. Attachment-Plug for Electric Circuits. F. H. Chapman and O. E. Kenney, assignors to Yost Electric Mfg. Co., Toledo, O. The plug has two telescoping sections, the inner one being a plunger; on pushing the plug in, the two parts move relatively to each other and the contacts on the plunger engage those of the Edison socket. The three patents cover modifications. (See cut.)

1,080,339. Thermostatic Circuit-Closer. J. Hartley, Philadelphia, Pa. Two contact disks are normally held apart by means susceptible to heat.

1,080,344. Process of Smelting Metals. J. D. Hilliard, assignor to New England Metal & Machine Co., Boston, Mass. The first step of the process consists in passing current through the mass to heat it up to the point of reduction.

1,080,354. Fire - Alarm Signal-Box. W. J. Leveridge, assignor to C. W. Leveridge, New York, N. Y. Breaking of the glass door releases the spring signal wheel and sends in the alarm.

1,080,355 System of Electrical Distribution. J. O. Luthy, San Antonio, Tex. Mechanism is interposed between the source and load circuits for successively and inversely varying the voltage in the latter circuits.

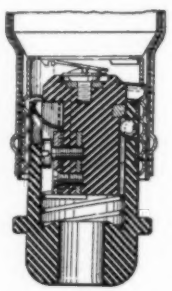
1,080,387. Brake for Electric-Motor-Operated Machines. M. Taigman, New York, N. Y. The brake lever is operatively connected to the starting lever on the starting box.

1,080,388. Electric - Motor Driving Unit. M. Taigman. An amplification of the above.

1,080,403. Means for Compensating Polyphase Alternating-Current Commutator Motors. E. F. W. Alexanderson, assignor to General Electric Co. Has a delta-connected compensating winding; each phase winding of the source is interposed between the compensating winding and a brush on the commutator.

1,080,405. Ball Joint. L. W. Andersen, assignor to Plume & Atwood Mfg. Co., Waterbury, Conn. For bracket lighting fixtures.

1,080,410. Shoe or Skate for Electric Railways. A. W. Barnhart, assignor to Electric Undercurrent Co., Pennsboro, W. Va. For a sectionalized third-rail system.



1,080,326.—Attachment Plug.

1,080,412. Siphon Recorder. S. G. Brown, London, England. Fibers suspend the siphon tube with its ink-inlet end coaxial with the axis about which the oscillatory recording movements of the tube take place.

1,080,414. Electric Clock. F. Brunko, Zurich, Switzerland. Includes an oscillatory electric contact member.

1,080,435. Machine for Facilitating the Packing of Magnetic Objects of Oblong Shape. O. Gamper, Zurich, Switzerland. Has a horseshoe electromagnet with a canal between its sides and feeding means to distribute the objects over the canal.

1,808,447. Tractor System for Motor Vehicles. A. H. Hoadley, Providence, R. I. Each of the front wheels is driven by an electric motor.

1,080,452. Apparatus for Controlling Air and Other Gas Compressors. G. E. Huttelmaier, Scottdale, Pa. A solenoid is energized when an excessive temperature is developed in the compressed air and this releases a pilot valve and thereby closes the steam valve.

1,080,475. Induction Motor. W. H. Powell, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Special means for securing the bars of a squirrel-cage rotor and clamping them to the short-circuiting rings.

1,080,480. Electric Fire-Alarm. F. Ricords and M. Lewry, New York, N. Y., assignors of one-third to S. Shapiro. Includes a number of separate lamp compartments and push-button switches.

1,080,483. Primary Battery. C. B. Schoenmehl, Waterbury, Conn. Suspended from the cover are two compressed copper-oxide plates between which and on each side of which is a zinc plate.

1,080,484. Galvanic Battery. C. B. Schoenmehl. A frame for supporting the copper-oxide plate.

1,080,493. Thermoregulator. W. J. Smith, Urbana, Ill. An electric heater with thermostatic switch.

1,080,496. Fuse for Electric Cutouts. L. E. Steward, Muncie, Ind. Within the end caps of an inclosed fuse are L-shaped terminals to which the fuse strip is fastened.

1,080,525. Reinforcing Pole. R. S. Orr, assignor to Pittsburgh Reinforcing Pole Co., Pittsburgh, Pa. A ferro-concrete reinforcement is put about the weakened part of the pole adjacent to the ground line.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 8, 1913:

572,525. Electric Elevator. J. P. Casey, Bloomsburg, Pa.

572,539. Electric Arc Lamp. C. Goodyear, Jr., New York, N. Y.

572,561 to 572,563. Elevator Signal Apparatus. S. B. Opdyke, Jr., Philadelphia, Pa.

572,607. Electric Signal Apparatus. G. Knowles, Milwaukee, Wis.

572,609. Telegraph System. B. F. Merritt, Orange, N. J., and J. M. Joy, New York, N. Y.

572,627. System of Automatic Electric Regulation. W. L. Bliss, Brooklyn, N. Y.

572,636. Electric Furnace. J. E. Hewes, Philadelphia, Pa.

572,639. Telegraphy. I. Kitsee, Philadelphia, Pa.

572,706. Electric Railway. R. M. Hunter, Philadelphia, Pa.

572,748. Electric Switchboard. E. A. Fordyce, Chicago, Ill.

572,754. Automatic Circuit-Closing Device for Galvanic Batteries. J. D. Holmes and W. L. Heath, St. Louis, Mo.

572,756. Telephone Transmitter. R. L. Hunter and H. B. Higgins, Minneapolis, Minn.

572,760. Printing Telegraph. L. Kamm, London, England.

572,775. Telephonic Apparatus. C. J. Schwarze, Adrian, Mich.

572,777. Electric Arc Lamp. T. Spencer and C. Toerring, Jr., Philadelphia, Pa.

572,801. Telephone Exchange. M. F. Hill, Cambridge, Mass.

572,805. Electric Lamp. L. A. Jackson, New York, N. Y.

572,840. Telephone System. A. F. Swan, Bayonne, N. J.

572,903. Regulating Electric Motors. H. W. Leonard, New York, N. Y.

572,923. Automatic Circuit-Closer. E. C. Williams, Clarksville, Tenn.

572,929. Electric Switch. C. H. Haberer, Louisville, Ky.

572,933. Trolley for Electric Railways. H. A. Seymour, Washington, D. C.

572,940. Support for Trolley Wheels. C. F. L. Orth, New York, N. Y.